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ABSTRACT

The report describes the Phase I findings of a two-phase study to determine the applications of commercial contract training to the Navy Training System. The objective of the study is to determine if commercial sources would be cost and training effective alternatives for current and peak Navy skill training requirements. The study was conducted by an interdisciplinary team of engineering, educational, and operations research personnel working for a period of 10 months. A limited number of Navy "hard skills" were selected for analysis as potential candidates for commercial contract training. Representative elements of the Department of Defense, other governmental training agencies, industry, and non-federal post-secondary training institutions were investigated in detail. This report provides a sampling of the various training programs, management systems, technological advances, instructional techniques, and curriculum and financial management practices potentially applicable to the Navy training system. Conclusions describe some of the characteristics and trends in civilian training programs and indicate a generally favorable reception to the concept of commercial contract training. (Author/MDW)

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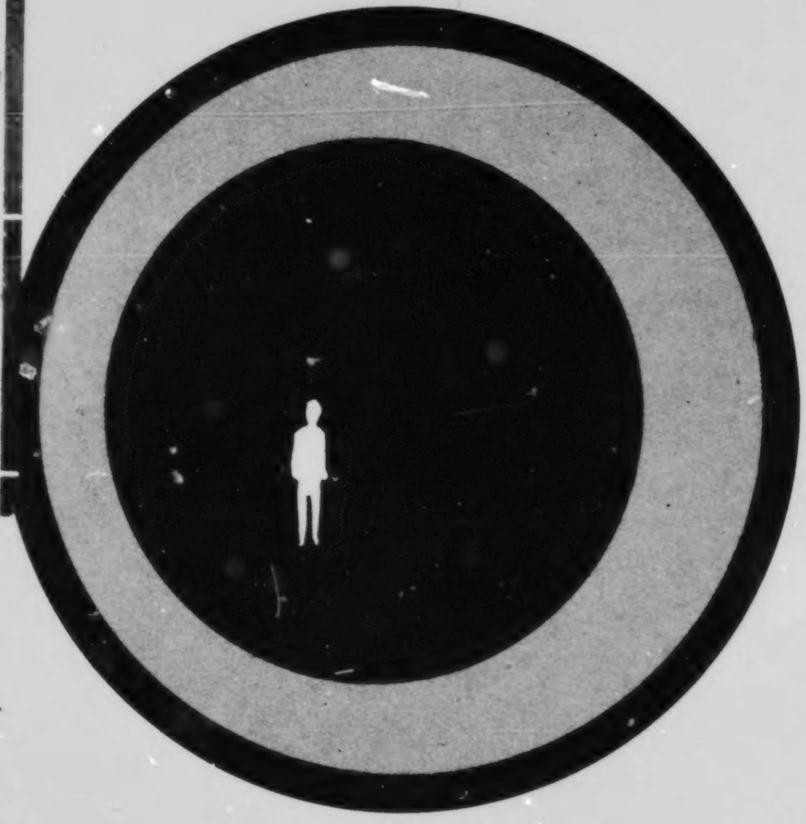

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This report describes the Phase I findings of a two-phase study to determine the applications of commercial contract training to the Navy Training System. The objective of the study is to determine if commercial sources would be cost and training effective alternatives for current and peak Navy skill training requirements. The study was conducted by an interdisciplinary team of engineering, educational and operations research personnel working for a period of 10 months.

A limited number of Navy "hard skills" were selected for analysis as potential candidates for commercial contract training. Representative elements of the Department of Defense, other government training agencies, industry, and non-federal post-secondary training institutions were investigated in detail.

This report provides a sampling of the various training programs, management systems, technological advances, instructional techniques, curriculum and financial management practices potentially applicable to the Navy training system.

The TAEG team was cognizant of the current and proposed Navy training programs (e.g., Campus for Achievement, Direct Procurement of Petty Officers (DPPO) Program) that might impact on this study.

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ANALYSIS OF COMMERCIAL CONTRACT TRAINING

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TAEG REPORT NO. 13-1

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TAEG REPORT NO. 13-1

FOREWORD

This report is the first of three planned reports documenting the results of a two-phase study of the feasibility of utilizing commercial sources to provide training for the Navy and Marine Corps in selected skill areas. The study, designated "CNT Project C-3," was conceived by the CNET (Chief of Naval Education and Training) Executive Staff and assigned to the TAEG by the CNETS (Chief of Naval Education and Training Support) on 14 August 1972. The scope of the study was expanded to include the Marine Corps per the 12 April 1973 request of the Commandant of the Marine Corps.

This report presents the findings of the Phase I analysis of the training capabilities, techniques, and management practices of industrial organizations and public and private training institutions surveyed during this study. Also included are discussions relevant to training economics and ASPR (Armed Services Procurement Regulation) considerations. Two Phase II reports are scheduled for publication in February 1975. TAEG Report No. 13-2 will address Navy training and TAEG Report No. 13-3 will address Marine Corps training. Both of these reports will be based on the Phase I data base and will include recommended plans for the administration, management, and implementation of the commercial contract training concept, including procurement considerations and techniques.

The study reported here was undertaken by a six-man team of interdisciplinary specialists. The team was composed of four Education Specialists (D. P. Copeland, T. Curry, C. Dean, and S. Gates), an

Economist (C. Morris), and an Engineer (R. Nutter). All team members have backgrounds relevant to training and training applications.

The Navy has long been a leader in, and contributor to, the field of education and training. Many of the current training practices, techniques, and equipment used in the civilian sector are products of, or were influenced by the Navy training system. The civilian sector has likewise made significant contributions to training and education. In addition to investigating the feasibility of commercial contract training, this study also explored the innovative training practices used in the civilian sector for possible Navy application. Regardless of whether the training is Navy or civilian motivated, the ultimate goal remains one of providing the best training, at the lowest cost, to meet the training needs of the Fleet.

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SUMMARY

INTRODUCTION

Approximately 8% (110 billion dollars) of the Gross National Product is devoted to national education. It was estimated that 6.6 billion dollars of the total national expenditure would be expended in FY 74 by the DoD (Department of Defense) for training and education.[1/] Even though the cost of training continues to increase, inflation continues to increase and manpower reductions continue; the Navy is forced to reduce their training costs to meet the current austerity requirements. Furthermore, these training cost reductions must be achieved with no adverse effects on the continuing efforts to improve the quality of Navy training.

Throughout the military services and the civilian sector, various alternatives are being explored, developed, and often discarded, to improve training quality while simultaneously reducing training costs. An alternative which has been explored and should be developed and not discarded is the concept of using commercial sources to train Navy personnel in selected basic skill areas. The task of exploring the feasibility of this alternative was assigned to the TAEG by the CNET. The Phase I (exploring) element of the task was concerned only with utilizing commercial sources for Navy selected basic skill training, the result of which are documented in this report. The Phase II (developing) portion of the task will be concerned with implementation of the concept for selected Navy and Marine Corps skill training.

The two-phase study includes both industry and public and private vocational/technical training institutions. Non-industry

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1/ U. S. News and World Report, June 18, 1973 training institutions are referred to as VOTECS. The study included personal examination of 30 industrial organizations. (The National Security Industrial Association provided data on 50 additional companies.) The examination of VOTECS concentrated on states having large Navy installations.

Most of the data for this study were collected during personal visits to industrial organizations and vocational-technical training institutions and by review of appropriate literature. Discussions with training personnel and direct observation of training in classrooms, facilities and equipment provided invaluable data.

CONCLUSIONS AND RECOMMENDATIONS

A summary of the major conclusions and recommendations of the Phase I Staff Study is presented below.

CONCLUSIONS

1. Industry and non-federal post-secondary training institutions have the capability and facilities to provide effective training to Navy enlisted personnel in basic technical and vocational skills. Contract training with these sources in selected skills provides an opportunity to greatly expand Navy training capability by providing technical training programs to supplement present Navy training, to eliminate costly duplication of existing civilian facilities, and to provide specialized training not offered by Navy schools.

2. The systems approach to training is widely used by industry and non-federal post-secondary training institutions in the development of training programs.

3. Industry recognizes the value of, and need for, cost effective in-house training and is applying innovative educational techniques to meet their training needs.

4. Public and private, non-federal post-secondary training institutions develop training programs to meet the specific needs of the community. Navy utilization of such institutions should be carefully considered since a disproportionate number of military students could adversely affect the civilian-military relationship.

5. Civilians trained in selected skills by non-federal post-secondary institutions can meet Navy "A" school level graduation requirements.

6. Many public area vocational/technical schools and junior/community colleges have established effective feedback systems which enable the user of their product (the trained student) to report changes in occupational training institutions to revise curricula as necessary to keep pace with technological advances.

7. The concept of commercial contract training does not require changes to the ASPR.

8. In general, both industry and non-federal post-secondary vocational/technical training institutions are receptive to the concept of conducting training for Navy personnel at the "A" school level and will tailor training programs to meet the specific needs and standards of the Navy.

9. The application of cost effectiveness and cost benefit analysis throughout the training program development cycle is an accepted practice in industry. Substantial cost savings can be achieved through utilization and refinement of such techniques in the Navy training system.

10. Only those commercial sources physically located within reasonable commuting distance of the students' assigned base should be considered for training military personnel at the "A" school or apprentice level.

11. Government and industry accounting systems are not structured to enable the determination of the true cost of training. A standard accounting system specifically designed to represent the true cost of training is required.

12. Industry has significantly increased the flexibility and capability of training facilities through the incorporation of advanced design concepts. Such concepts have proven effective in reducing maintenance and modification costs.

13. There is a trend within industry to centralize training management control within the corporate structure. Many of the management practices and philosophies of industry have beneficial application to the Navy.

14. The majority of industrial activities develop career professional educators and instructors, advancing qualified personnel on merit to management level positions.

15. Personalized training programs in being and under development in the civilian sector have application to Navy development and planning.

16. Those industrial activities that have long-range training plans and strategies have the most effective training programs.

17. Standardization of training facility design, instructional equipment, instructional techniques, and training curricula is a standard practice within industry.

18. Instructors in industry are required to attend professional instructor training courses prior to classroom instruction.

19. Commercial training sources have the capability and facilities to provide training to Naval Reserve personnel. Such sources should be considered in mobilization planning.

20. Commercial training sources require evaluation on an individual and competitive basis due to the lack of standardized criteria for goal achievement in the area of technical skill training.

21. Industry is experimenting with, and using, many advanced education and training concepts to improve the effectiveness and efficiency of training.

RECOMMENDATIONS

A. Management

1. The CNET should continue to support efforts directed toward centralized training management. This philosophy is accepted in industry as the most efficient means of achieving positive program control, training program continuity, training effectiveness, training efficiency, training standardization, training cost reductions and effective program planning.

2. A full-time staff activity responsible for long-range planning strategy should be established by CNET. The functions of this staff should include as a minimum:

   a. The impact of foreign national policy on Navy training.

   b. The impact of DoD policy on Navy training.

   c. The impact of new weapon systems on Navy training.

   d. The application of long-range R&D efforts in education and training technology to Navy training.

3. Continued effort should be devoted to the standardization of education and training technology. This should include all facets of education and training.

4. The CNET should continue efforts to consolidate education and training facilities. Such consolidation effort should include consideration of the current efforts being devoted to the concept of interservice training.

5. The efforts being devoted by the CNET to improve communication channels through exchange of training and education data between subordinate commands, other services, and civilian activities should be continued.

6. The CNET should initiate a program to simplify the RMS (Resource Management System) to effect maximum utilization of personnel and equipment in its training programs.

7. Continued effort should be directed toward the centralized control of training and education research and development programs.

8. The CNET should adopt standardized task analyses methods. Administrative procedures and appropriate guidelines should be established to insure that task analysis is applied during the acquisition of all new weapon systems and platforms and during all training development programs.

9. The CNET should continue efforts, within the areas examined in this study, toward interservice training and the use of appropriate DoD agency schools to satisfy Navy basic skill training needs. Progress in this area will result in training cost reductions for the Navy and increased training management efficiency.

10. Emphasis should continue to be placed on the development of an effective Navy-wide feedback system for education and training. An

effective feedback system, accepted by all Navy commands, will greatly increase the efficiency and effectiveness of Navy training.

11. A career field relating to education and training should be established for Naval officers, enlisted, and civilian personnel. This career field is required to elevate the professional status of Navy education and training personnel and to maintain the program continuity of all training and education activities.

12. The current effort being devoted to improving instructor training techniques and methodology should be continued. The concept of classroom managers should be included in instructor training curriculum. Consideration should be given to mandatory periodic refresher instructor training to keep Navy instructors abreast of the latest changes in training technology and instructional techniques.

14. Continued effort should be directed toward the standardization of training and education terminology. This effort should be considered by personnel charged with the responsibility for interservice training and education.

15. Procedures should be established to realign techniques for inspection and evaluation of Navy training programs. Such procedures should be specific in nature to permit meaningful evaluation of the effectiveness and efficiency of training programs.

16. A standard technique for economic analysis should be established for the education and training community. This technique should be based on the basic economic analysis concepts set forth in Section VII of this report.

17. The CNET should continue efforts for the certification and accreditation of Navy skill and technical training courses.

18. Continued effort and growth should be encouraged for the standardization of training aids and devices. The effort being devoted to consolidation and standardization within the cognizance of the CNETS closely parallels the consolidation and standardization philosophy of many industrial organizations.

19. The CNET should consider the utilization and application of the concepts set forth below in appropriate Navy training situations:

a. Cognitive style mapping

b. Managed on-board training vs on-board training (e.g., formalized control vs non-formalized control)

c. Shipboard satellite training

d. CAI remedial education

e. Civilian recognized Navy training certificates

f. Motivation as a major education and training consideration (e.g., this includes job induced (extrinsic) as well as such intrinsic motivation as attitudes and incentives to perform).

g. Modular structured courses (increased emphasis).

20. The CNET should consider non-federal post-secondary training institutions as training sources in mobilization planning.

21. Non-federal post-secondary training institutions should be considered as sources for appropriate Naval Reserve training. These institutions are curently being used for certain types of Marine Corps Reserve training.

22. The CNET should establish programs to improve the classification procedures for new personnel.

PHASE II PLANS

The Phase II portion of this study will provide two VOTECS implementation plans, one for the Navy and one for the Marine Corps. The Navy plan will be completed in February 1975 and will include the following:

1. Sample VOTEC specification
2. Program of instruction for LI (Lithography) rating
3. Economic analysis techniques applicable to Navy and Marine Corps in-house training and for proposed commercial contract training
4. Management consideration and contract training feasibility programs
5. Contractual techniques for commercial contract training
6. List of qualified VOTEC institutions near Navy installations
7. Comparative cost analysis

SECTION I

INTRODUCTION

This report presents a study on the feasibility of using commercial sources to provide training to Navy enlisted personnel in certain vocational/technical skills. A "commercial source" is defined as any non-federal industrial organization or non-federal post-secondary public or private institution engaged in vocational/technical training.

The Commercial Contract Training project is a two-phase study. Phase I, presented herein, considers only Navy basic skill training requirements. Phase II will address Navy and Marine Corps skill training as authorized by the CNET on 7 May 1973. The Phase II Navy/Marine study will be conducted concurrently because of the similarity between study objectives. Final recommendations and training plans regarding the utilization of commercial sources for selected Navy and Marine Corps skill training will be developed at the conclusion of Phase II. These recommendations will address the issues of concept implementation, management, administration, cost and mobilization application and will be forwarded to the CNET and the Commandant of Marine Corps for consideration.

OBJECTIVES OF THE STUDY. Two primary objectives were established by the CNET for this study:

(1) Identify commercial sources which possess capabilities for providing relevant and effective training in selected specialties in support of the Navy training system.

(2) Develop plans and methodology for conducting Navy skill training under contract during periods of high, abnormal training load requirements.

A secondary objective of the study was to identify unique and innovative civilian training approaches and practices in the areas of management, program development, instructional techniques, instructional software and hardware and cost controls which have potential application to Navy training. This objective was structured to satisfy the stated CNET task.

SCOPE. The scope of the study examines the issues involved in Navy training and education, and Navy training in selected basic skill areas. For our purposes, the distinction between training and education follow the definition set forth below:

> "In studies of education and training programs in the U. S. Armed Forces, the terms "education" and "training" are frequently used interchangeably or training is used all inclusively. While there are no absolute distinctions between the two terms, it has been found useful to differentiate them. Training programs are those which develop specific skills, are job oriented, or apply to a particular military specialty; they are likely to deal with large numbers of personnel and with expensive equipment and facilities. Education programs tend to be complex, implying instruction or individual study for the purpose of intellectual development and the cultivation of wisdom and judgment; these programs are usually smaller in volume and do not require extensive facilities beyond classrooms, libraries, and laboratories." (Ref. 125, page 843)

Using this definition of training as the governing criteria, the scope of the study was limited to the specific areas identified below:

(1) Twelve Navy skill ratings (Refer to Table 1)

(2) Basic skill training ("A" school level)

(3) Training and Education institutions near highly Navy populated areas (Refer to Table 2)

TABLE 1. SELECTED NAVY RATINGS

RATING	NAVY TRAINING LOCATION
ELECTRONIC TECHNICIAN (ET)	GREAT LAKES; SAN DIEGO
DATA SYSTEMS TECHNICIAN (DS)	SAN DIEGO; MARE ISLAND
INSTRUMENTMAN (IM)	GREAT LAKES
YEOMAN (YN)	SAN DIEGO; ORLANDO
JOURNALIST (JO)	FT. BENJAMIN HARRISON
COMMISSARYMAN (CS)	SAN DIEGO
LITHOGRAPHER (LI)	(NO FORMAL TRAINING COURSE)
ILLUSTRATOR/DRAFTSMAN (DM)	(NO FORMAL TRAINING COURSE)
ELECTRICIAN'S MATE (EM)	GREAT LAKES; SAN DIEGO
ENGINEERING AID (EA)	PORT HUENEME
EQUIPMENT OPERATOR (EO)	PORT HUENEME
STEWARD (SD)	SAN DIEGO

TABLE 2. GEORGRAPHICAL SURVEY AREAS FOR VOCATIONAL/ TECHNICAL EDUCATIONAL INSTITUTIONS

SAN DIEGO, CALIFORNIA	GREAT LAKES, ILLINOIS
NORFOLK, VIRGINIA	ORLANDO, FLORIDA
PENSACOLA, FLORIDA	MEMPHIS, TENNESSEE

(4) Skills not requiring large capital outlays with low volume student input

(5) Representative commercial sources (Refer to Table 3)

(6) Development of a training cost model

(7) Contractual techniques (including ASPR implications) applicable to procurement of training from commercial sources.

APPROACH. The early stages of the study were unstructured to permit flexibility of observation so as to promote the broadest view. As the study proceeded, the information collection procedures became more structured as the data base developed. The study approach eventually evolved into a collection of relevant data through interview, observation and the examination of published data. These data collection techniques were supplemented with questionnaires (Refer to Appendix B) specifically designed for the study approach selected. The questionnaires developed for this study were structured to permit the collection of comparable data from public and private education institutions, industrial corporations, and Government agencies.

On 26 February 1973, Admiral J. M. Lyle, USN (Retired), President of the NSIA (National Security Industrial Association) offered, at no expense or obligation to the Government, the resources of his organization to support the TAEG team in the collection of industry data. Data forms developed by TAEG (Appendix B) were provided to the NSIA for the collection of industry data.

A representative sample of commercial sources involved in vocational/technical training was selected for in-depth analysis. The selection criteria varied dependent on the type of source under consideration. For

TABLE 3. COMMERCIAL SOURCES CONTACTED

INDUSTRY	EDUCATION INSTITUTIONS
American Airlines	Mid-Florida Technological Institute
American Telephone & Telegraph	Pensacola Junior/Community College
Boeing Company	Valencia Junior/Community College
Coca Cola Company, USA	Embry-Riddle Institute
Control Data Institute	San Diego City College
Delta Airlines, Inc.	San Diego Mesa College
Eastern Airlines, Inc.	San Diego Evening College
Flight Safety, Inc.	Grossmont College
Florida Gas Company	New Careers Institute
Florida Power Corporation	State Technical Institute at Memphis
Ford Motor Company	George Stone Vocational Technical Center
General Electric Company	Tidewater Community College
Goodyear Tire & Rubber Co.	Norfolk Technical Vocational Center
General Motors Corporation	Lynchburg Vocational School
Grumman Aerospace Corporation	New York Institute of Technology
International Business Machines	Rollins College
Eastman Kodak Company	Nova University
McDonnell-Douglas Corporation	Florida Technological University
Martin-Marietta Corporation	Wymore Vocational Technical Center
RCA Service Company	Seminole Junior College
Singer	Mira Costa College
Sperry Rand	Palomar College
Southern Bell	Southwestern College
Texas Instruments, Inc.	Norfolk State College
Trans-World Airlines, Inc.	College of Lake County
United Airlines	Gateway Technical Institute
Virginia Central Industries	Kenosha Technical Institute
Westinghouse Electric	Racine Technical Institute
Western Electric	Walworth County Campus
Xerox	

example, only those public and private vocational/technical institutions in close proximity to areas highly populated with Navy personnel were considered. This decision was based on the cost savings that would accrue to the Navy in terms of the significant reductions in student travel costs, per diem, time factors and in the availability of administrative support, berthing and messing facilities. The undesirable aspects of completely removing the young, impressionable student from the Navy environment also influenced this decision.

Industrial sources were selected on the basis of size, training specialties, training research activities, training management philosophy and established reputation for high caliber and innovative training programs. Geographical location was not a determining factor in the selection of the industrial portion of the sample. Private vocational/technical institutions were classified as industrial sources since they are profit oriented and had to be treated as such in the economic analysis.

Various levels of management personnel were interviewed including company presidents, vice presidents, agency directors, as well as skilled technicians. In all instances, their cooperation was excellent. It should be noted that a portion of the data gathered is classified "company proprietary" (especially in the area of cost data) and was obtained only by the establishment of a rapport with company personnel and with assurances that the data would not be identified with the sources. Therefore, we have not provided any indication which correlates specific data sources in this report.

Data obtained from the sources contacted were supplemented with data obtained from a DDC (Defense Documentation Center) literature search and in-house literature searches. These data were cataloged, filed, and subjected to in-depth analysis by each project member.

REPORT ORGANIZATION. Seven major sections are presented in addition to this Introduction. Sections II, III and IV address the specific issues of techniques and trends in "Industry Training," "Post-Secondary Training" and "Selected Navy Training Programs." These three sections are each structured to present an overview of such training considerations as instructional techniques, cost, management philosophies, personnel, facilities and training capability. The possible application of the various commercial training innovations and techniques to Navy training programs is discussed.

Sections V, VI, and VII serve as binder sections to support the study findings presented in Sections II, III and IV. Section V provides a "Curriculum Comparison" between comparable skill training programs of industry, Navy and public and private training institutions. Section VI presents an in-depth discussion of the implications of commercial contract training on existing Armed Service Procurement Regulations. Section VII discusses the TAEG developed training cost model, including basic theories of economics, Navy commercial training cost application, economics of training time compression and the need and concept for revising current Navy training cost philosophies. The "Conclusions and Recommendations" resulting from this study are presented in Section VIII.

Three appendices are provided. Appendix A lists the personnel contacted during the study; Appendix B includes the questionnaire used in the data collection; Appendix C summarizes the data related to industrial organizations surveyed during the study.

SECTION II

INDUSTRY TRAINING

This section of the report presents the study findings relating to industry training programs, practices, and techniques. Emphasis is placed upon data which identifies industry training trends in the areas of management, program development, personnel, instructional techniques, instructional hardware and software, training capability, economics, and facilities.

The issues and concepts addressed in this section have not been subjected to the in-depth analysis necessary to determine specific application to Navy training. This will be accomplished during the Phase II development of a commercial contract training implementation plan(s). The most promising concepts will be selected, modified if necessary to meet specific Navy requirements, and included in the implementation plan.

MANAGEMENT. The quality, effectiveness and magnitude of an industrial organization's training program are ultimately reflected in the philosophy of the organization's management regarding the need for training and the value of training. Throughout industry, management is placing increased emphasis upon the importance of in-house training programs. This change in philosophy has occurred during the past decade and is attributable to the enactment of major changes in training policy by management. Historical developments which influenced these changes in training philosophy and policy include:

1. Shortage of skilled labor
2. Rapid pace of technological advances
3. Recognition of training investment payoff
4. Increasing training costs
5. Increasing variety of jobs [2]
6. Public emphasis on unemployables (Minority groups)
7. Personnel obsolescence
8. Organization obsolescence

These factors have significantly increased the demands placed upon management to provide initial and refresher training to large portions of the labor pool in a variety of occupational fields. The extraordinary growth of industry training programs in recent years is primarily due to the on-going "technological explosion." This "explosion" is taxing the ability of people to maintain their currency and affects practically every occupational field, including managers as well as professional and skilled personnel. Many industrial personnel believe that employees may soon have to be completely retrained in their occupational field every five years to keep pace with technological advances.

In order to respond effectively to the increased requirements for training, industry management has had to adopt many new training policies and training-influenced philosophies. The large financial expenditures now devoted to employee training and the positions of responsibility now occupied by training managers are two examples of these new training policies and philosophies.

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[2] The Dictionary of Occupational Titles now lists over 30,000 entries.

Many of the new training policies have required management to authorize the expenditures of large sums of monies. In recent years, there have been increasingly large capital investments in training programs directed toward facilities, professional course development, media and instructional equipment, and research. Management emphasizes and promotes training within their organizations and justifies the large expenditures of monies by equating this training with payoff in increased profits and productivity. Representative industry training expenditures are presented in Section VII.

Training responsibility, now vested in high management positions within the corporate structure, indicates the importance industry management places on training and the impact of new training policies adopted by management. The responsibility for internal employee training is normally placed at the director level, and the responsibility for customer training is normally at the vice president level.

The new training policies of management are further illustrated by the trend toward centralized control of training by a single group within the corporate structure. For example, a small permanent staff of high salaried professional personnel establishes and insures implementation of training policy for 200,000 company employees.

Management's decision to centralize or decentralize training depends on such variables as product line, organization size, internal and external training requirements, and economic posture. Centralization of training may satisfy the requirements of one organization but not the other.

Industry management generally considers the following conditions in decisions pertaining to centralization or decentralization of training facilities:

. Decentralized training facilities appear to offer economical benefits where training requirements are such that training must be applied to large numbers of personnel over large geographical areas.

. Centralized training facilities are advocated by those organizations geared to a specific product or service and are reasonably self-contained within a geographical area.

. Organizations having "average" training requirements will semi-decentralize by establishing six to eight training centers to serve large regional areas.

The progressive viewpoint of industry management toward training is reflected in their awareness of the need to maintain a high degree of professionalism among their own ranks. This is being accomplished throughout industry by the expenditure of large sums of money for executive and management level training programs. These training programs are sometimes offered to Government and military executive personnel at no cost.

The training policy changes enacted by management in recent years are reflected by the evolution of certain trends common throughout industry. Some of these trends are identifiable in Navy training; others are not. These trends in training are addressed in appropriate sections of this report and will be subjected to in-depth analysis during Phase II relevant to their application to Navy skill training requirements. The trends in industry training are toward:

1. Centralized management control
2. Centralized training facilities
3. Application of the systems approach to training
4. Application of cost benefit analysis totraining
5. Professional curriculum development specialists
6. Professional training instructors
7. Personalized training programs
8. Standardized training curricula
9. Self-paced individualized instruction
10. Certification and recertification programs
11. Compression of training time
12. Application of innovations in educational technology
13. Recognition and inclusion of training in career development plans

The current training philosophy of industry management, exemplified by these trends, has not evolved without the expenditure of large sums of money. These expenditures are considered necessary in terms of long-range benefits. Management has become an exponent of the human resources viewpoint through recognition of the opportunity to profit from the development of these resources to achieve a capital gain on their investment. Efficient training programs which produce qualified personnel pay dividends over and above the capital investments of the training programs. This principle applies to Navy training as well as industry training.

PROGRAM DEVELOPMENT. Industry considers an efficient program development system to be a key element of effective training programs. This is reflected by the emphasis placed on the development and refinement of more effective program development techniques.

Any effective training organization must be able to:

(1) Determine and define true training requirements

(2) Render training by the most effective means to satisfy the training requirements in the least time and at the lowest relative cost.

Industry has achieved great success in accomplishing these tasks through the utilization of efficient program development techniques. This success is due primarily to the application of the systems approach to all phases of the program development cycle. Through this application, Industry has eliminated many courses which "entertain rather than train." Industry considers the most effective training programs (i.e., those which are based on achievable performance objectives, provide only need-to-know information and experiences, and yield validated measurable results) to be those based on the systems approach.

The methodology of different industrial organizations is basically the same in the application of the systems approach to training program development; there are, however, certain variations which reflect the unique training environment of the organization. These variations are reflected in the training system model, a basic element of the systems approach. Typical industry training system models, the basic concepts upon which they are based, and their common development steps were subjected to in-depth analysis during this study.

Although no single training program development system is used by industrial organizations, there are basic development steps which are common to the majority of industrial training program development systems. These common development steps are:

(1) Problem analysis

(2) Task analysis

(3) Media selection

(4) Cost benefit/cost effective analysis

(5) Course development

(6) Development testing, revision, validation testing

(7) Measurement of performance

(8) Training feedback

The purpose of problem analysis (normally the first step in program development) is to determine if a training problem exists, and if it does, to define what the training is supposed to accomplish prior to investing in the program. A preliminary value and worth analysis is normally conducted as part of the problem analysis step. The purpose of the value and worth analysis is to avoid expensive false starts and the completion of training programs that cost more than they are worth to the organization.

The task analysis step, normally conducted early in the program development cycle, requires the collection of data in behaviorally stated requirements of what the trainee must be able to do, the conditions under which he performs, and the criteria for acceptable performance. This is normally conducted by an education specialist working with a subject matter specialist.

Industrial organizations do not have training media selection techniques as advanced as those set forth by the TECEP (Training Effectiveness and Cost Effectiveness Prediction) concept under development by the TAEG. Although increased emphasis is being placed on the training and cost effectiveness aspects of media selection, experience and judgment continue to determine training media selection in many cases. Cost is also a major consideration in the media selection step.

Cost effectiveness/cost benefit analysis is considered by many as the most important step in program development. This follows management's philosophy that training funds are allocated on a continuing basis only when they can be favorably related to the financial statement. Innovative applications of cost effectiveness/cost benefit analysis to training are addressed in Section VII.

The success of the course design step is considered by most industrial organizations to be dependent on the thoroughness of the front-end analysis conducted earlier in the program development cycle. Success is also equated with application of the "need to know" vice "nice to know" concept, a key trend in industry course design. Professional education specialists, who draw upon the expertise of subject matter specialists, normally design industry training courses. Few organizations require the instructor or subject matter specialist to assume full responsibility for course design.

The course design step is generally followed by a period of development testing, revision and validation testing. The manner in which this testing is accomplished varies between organizations. Student subjects are sometimes used to test the efficiency of training programs in meeting established objectives.

Industry recognizes performance measurement and training feedback as essential steps in the program development cycle. Unfortunately, current techniques are marginal and only limited effort is being devoted to developing more effective techniques for performance measurement and training feedback. Typical training feedback vehicles include questionnaires, test results, personal observations and performance evaluations.

Not all industrial organizations possess an in-house training program development capability. These organizations either (1) rely on local training institutions for employee training or (2) procure the services of specialized commercial firms for the development of employee training programs. Most organizations expressed satisfaction with either approach.

Training program development techniques used by industry appear to be effective and efficient in most areas. The probability of successfully applying the more promising techniques to Navy training program development is high. Industry's techniques for media selection, performance measurement and training feedback do not appear at this time to offer significant benefits to Navy training.

PERSONNEL. The role of the instructor (sometimes referred to as trainer or instructional manager) in the industrial training complex was the primary personnel issue of interest to the study. Emphasis was placed upon instructor duties, responsibilities and qualifications.

Industrial organizations view the position of instructor as one of prestige and as the first level of management. It is considered a definite step in an employee's career development and normally involves promotion either before or after the employee assumes the position; it is reserved for exceptionally qualified employees.

The instructor normally occupies his position on a full time basis for a period of 24 to 30 months. He is often a subject matter specialist in the training courses he conducts. The new industry instructor normally attends a 2 to 3 week instructor training course prior to conducting a training course. Typical instructor training courses include familiarization with training aids and instruction in delivery methods and instructional techniques. In addition, the new instructor is frequently given on-the-job training and the opportunity to audit the course he is to conduct.

The duties and responsibilities of the instructor vary between organizations. They are a function of the type of training, instructional methodology and organization training policy. For example, the instructor is more likely to have complete responsibility for course design and course conduct in the hard skill training areas, particularly if the course is lecture oriented. Responsibility for complete course design, however, is normally not assigned to the instructor. In many instances the instructor is provided with professionally designed curriculum packages. He may serve as an "instructional manager" where self-paced instructional techniques are used.

Instructor load does not normally exceed 15 students per class. Many industry personnel believe that more than 10 students per class reduces training effectiveness.

Supervisors normally evaluate the instructor's performance over a specified period of time. The results of student critiques are often considered by the supervisor in evaluating instructor performance. Some organizations are even applying computer technology to assist in the determination of instructor performance and course effectiveness.

Industry instructors are normally well qualified for their positions. Their duties, responsibilities and training have certain characteristics which should be considered for application to Navy instructors' positions.

INSTRUCTIONAL TECHNIQUES. The ultimate success or failure of a training program is often attributable to the instructional technique(s) utilized. For this reason, industry is actively exploiting the advantages of new and innovative instructional techniques to effect cost savings and increase training efficiency. The growing interest in new instructional techniques is due to two major factors:

(1) Progressive training policies of management

(2) Acceptance and application of the "systems approach to training"

Industrial training organizations are using, and experimenting with, numerous instructional techniques to support their internal training programs. Some techniques are innovative variations of the standard classroom lecture; others represent effective application of advanced education and technical concepts; some appear to be only passing fads not worthy of the expenditure of time or funds. Industry instructional techniques of most interest to the study are:

(1) Classroom lecture

(2) Programmed instruction

(3) Self study

(4) CMI (computer managed instruction)

(5) CAI (computer assisted instruction)

(6) CCTV (closed circuit television)

(7) Video tape

The standard classroom lecture is the most common instructional technique used in skill, technical and professional training programs. Effectiveness has increased significantly through application of the "need to know" vice "nice to know" concept and through the use of supplemental instructional techniques and aids such as CCTV, motion pictures, simulators, sound slide programs and film strips. Industry considers the classroom lecture:

(1) Most effective where the students are similar in background and goals

(2) Less effective where student background and goals are somewhat diverse

(3) Completely inadequate in situations of extreme diversity

Programmed instruction is one of the most widely used and accepted instructional techniques in industry. It is used for internal employee training and for consumer market. Programmed instruction effectiveness tests have indicated that students learn 10% to 25% more, learn the subject faster, and complete courses in 25% to 50% less time (Ref.38). Off-the-shelf programmed instruction courses are effective if they meet the specific needs of the user. Benefits of this instruction technique include:

(1) Reduces training time

(2) Increases learning over conventional techniques

(3) Transmission of learning to job performance

(4) High quality instruction

(5) Part time instructor-administrator

(6) Approaches private training

Industry uses CCTV primarily as an adjunct to training (not as a primary instructional technique) and in some instances for pre-skill and post-skill development testing. CCTV is not frequently used in industry training programs. Conversely, the use of video tape is increasing due to the variety of instructional situations in which it may be used (i.e., instructional material presentation and as a feedback medium). Course time compression of 4:1 and 6:1 over conventional techniques has been achieved by video tape (Refs. 139, 140 and 141). This compares to an estimated time compression of 2:1 for CAI (Ref. 139, 140, and 141).

Computer based instruction systems, such as CMI and CAI, have an inherently high element of fixed expense associated with course development, course maintenance, hardware and system management. In addition, the ratio of author preparation time to student course time may vary from 20:1 to 250:1. For these reasons (not instructional effectiveness) industry maintains a position of caution before implementing these computer based systems on a large scale. Organizations possessing the capital to invest in these systems for internal employee training appear satisfied with results obtained. They consider computer based training systems most effective for stable courses that are not subject to frequent change and characterized by specific answers and discrete knowledge. Capital investment is the primary objection to this instructional technique. Two alternatives for reducing the fixed expense per student instruction hour are:

(1) Spread the instructional and hardware (including line) expense over the largest possible number of students

(2) Share the hardware (including line) expense with other terminal based operations

The self-study instructional technique is frequently used by industry for employee training. Self-study courses are self administered with assistance provided by instructional managers.

Industry is developing, and using in a limited capacity, various instructional techniques which may have potential application to Navy training. These include learning centers, mobile training units, satellite transmission and lending libraries. These and other concepts were investigated during the study.

The instructional techniques discussed in this section were selected as representing the current trends in industry. Numerous other techniques are being developed to reduce training costs while simultaneously improving upon training effectiveness. The large number of instructional options available requires training and management personnel to thoroughly analyze training requirements in order to effectively choose, cost justify, and implement these new options. This applies to Navy as well as industry personnel.

Although many instructional techniques are available, the trend is toward the standard classroom lecture supplemented with audio/visual aids, heavy use of self-study techniques, and cautious acceptance of computer based training systems. The instructional techniques in use and under development by industry appear to have direct application to Navy training.

INSTRUCTIONAL HARDWARE AND SOFTWARE. The effectiveness of a training program is a measure of many inter-related factors, including instructional hardware as well as instructional technique. The issue is complicated by the fact that the effectiveness of instructional hardware is assessed not only by its contribution to the learning process but also by such technical considerations as reliability, maintainability, cost and performance. Training personnel are faced with a greater selection of instructional equipment than ever before. Due to the large selection, industry emphasizes the careful examination of all considerations prior to the design or purchase of new instructional systems.

Numerous instructional systems were investigated during the study. Those considered the most unique and having the greatest potential for future development are presented in this report. The specific instructional concepts of interest to the study include:

(1) Vocational skill evaluation system

(2) Computer instructional system

(3) Interactive training

(4) Skill training kits

(5) Learning centers

(6) Training via satellite

(7) Learning carrels

(8) Simulation devices

Industry is developing systems to support concepts for determining the vocational aptitudes, interest and work tolerances of participants prior to their entering comprehensive skill training programs. One such system consists of 10 work stations, each station equipped with the tools and instructional aids necessary to describe and provide "hands on" experience in a specific occupational area. The system uses the self study, "hands on" approach to familiarize participants with such occupational areas as drafting, plumbing, refrigeration and electrical wiring. Many training institutions are using this system to assess student interests and skills to increase their chances of succeeding in training and employment. Such aptitude evaluation systems are potentially applicable to Navy recruit training assignment, classification, and Category III and IV placement.

Those organizations committed to computer based instructional systems have developed unique applications of computer hardware and software technology to increase training efficiency and effectiveness. Representative of these applications is the instructional system which operates on a common teleprocessing network serving 450 student terminals in 200 branch offices in the United States, Hawaii, Puerto Rico, Canada and Mexico. This system provides approximately 80,000 training days per year to company employees. Computer based instructional systems are used in multi-media approaches including CAI, CMI, programmed instruction, film and microfilm. These systems provide administration functions such as student direction, student testing and grading, control and timing of student projects, course status and record keeping. In addition, mini-computers are being used to drive multi-student stations of interactive instructional systems using a CRT (cathode ray tube), microfiche and audiofiche to facilitate the learning process.

Some organizations are marketing educational kits based on internally developed employee training programs. Such kits are available for a multitude of professional, vocational and technical subjects. They normally include cassette cartridges, filmstrips and/or slide systems for subject matter presentation; others require student access to sophisticated equipment such as computer systems. In-depth analysis is required to determine the application of these instructional kits to specific Navy training requirements.

The "learning center" is a relatively new hardware oriented concept being used by some organizations for vocational and professional training. It may be used for individualized or group instruction. Consideration is being given to expanding the concept to provide interactive audio/visual instruction for groups in separate locations and maintaining student performance records by linking student responders to a central computer system.

Training and education via satellite is an interesting concept having potential application to Navy training. The concept is being developed for Alaska as a technique to provide education and training to low density populations in remote areas. It could possibly be expanded to provide remedial and refresher training to Navy personnel in remote stations and on-board ship.

The use of video tape for certain training applications has increased in recent years. One reason for this increase is the high course time compression ratios stated by advocates of video tape. It was not determined if these ratios are based on "conventional lecture" courses or on courses designed to specific behavioral objectives.

Learning carrels are widely accepted by industry as effective training support equipment. Some activities have provided over 100,000 student training days to their employees in learning carrels in a one year period. They come in a variety of designs and are used for professional and vocational training.

The modern simulator is an excellent example of the effective application of technology to facilitate training. For example, the aircraft simulator has proven to be an efficient training vehicle by significantly reducing training time and increasing training effectiveness and safety. Airline pilots now transition to new aircraft with only 2-3 hours flight time in the aircraft. Other types of simulators are equally effective. 3/

It is significant to note that where total training requirements have been realistically defined, industry has responded with functional approaches to develop the necessary learning materials, equipment, maintenance concepts and personnel required for growth and change. Conversely, many instructional systems have been brilliantly conceived but with little thought given to the cost of system support or to training effectiveness. Accordingly, many cost and training effective instructional systems are available to support the training requirements of industry; however, there are equal numbers of ineffective instructional systems on

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3/ Statistical data provided by major airline training organizations such as American Airlines, Eastern Airlines, Delta Airlines, United Airlines and National Airlines support the effectiveness of simulators for pilot training.

the market which are little more than "novelty" items. This disparity requires training personnel to be sensitive to their specific training requirements before selection of instructional hardware. Newness for the sake of newness is not a valid criteria for this selection.

TRAINING CAPABILITY. Throughout this report, reference has been made to the changing posture of training within the industrial complex. The shortage of skilled labor, rapid changes in technology, personnel obsolescence, public programs, emphasis on hiring unemployables and recognition of training investment payoff were the major factors leading to this change. In satisfying the training and education demands imposed by these factors, industry established an impressive training capability in practically every occupational field.

The growth of this training capability is illustrated by the data presented in Figure 1 and Tables 4 and 5. The data were developed by an industrial organization concerned with determining the training trends within its own structure. The continual increase in training manhours (Figure 1) and the high percentage of training devoted to hourly (Table 5) and technical knowledge and skills (Table 4) are representative of current training trends in industry.

There are many types of data which serve as useful "indicators" of an organization's training capability. These include:

(1) Training Man-hours

(2) Training Investment

(3) Number of Courses

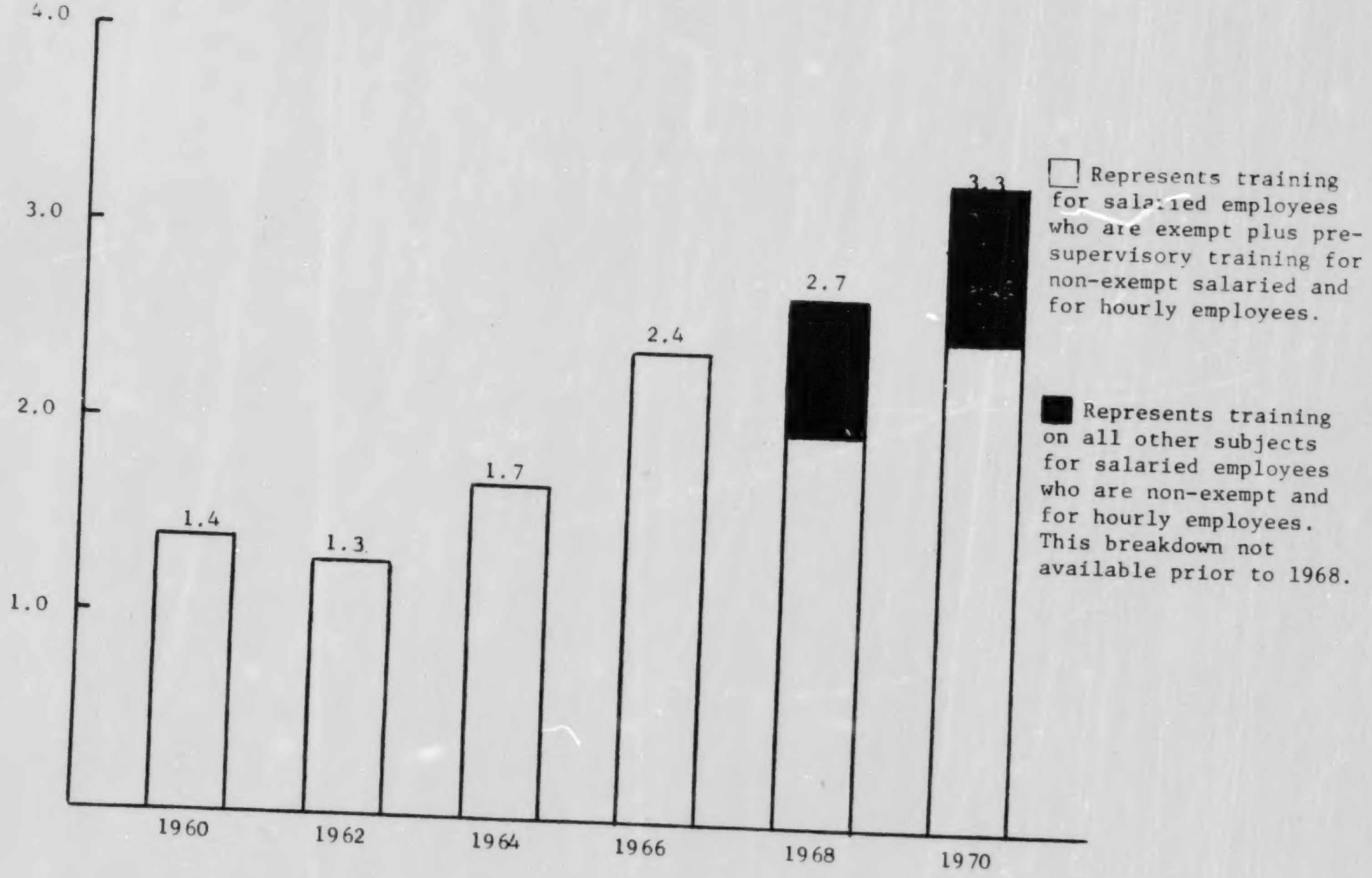

Figure 1. Total Man-Hours of Training (Millions)

TABLE 4. DISTRIBUTION OF TRAINING HOURS BY TOPIC

TOPIC	HOURS	% OF TOTAL
Technical Knowledge & Skills	1,115,000	35%
Managerial Knowledge & Skills	458,000	14%
Understanding or Administering Specific Programs	353,000	11%
Formal Pre-Supervisory	334,000	10%
Employee Relations	281,000	8%
Labor Relations	229,000	7%
Personal Skills	152,000	5%
Organization or Policy	116,000	3%
Miscellaneous	224,000	7%

TABLE 5. TRAINING MAN-HOUR BREAKDOWN

EMPLOYEE CATEGORY	TRAINING MAN-HOURS	PERCENT OF TOTAL HOURS
Foreman	758,000	23%
General Foremen	174,000	5%
First Level Salaried Supr	245,000	7%
All other Supervisors	297,000	9%
All other Exempt	717,000	22%
Non-Exempt	349,000	11%
Hourly	760,000	23%
	3.3 Million	

(4) Type Training Programs

(5) Facilities

(6) Instructional Techniques

Extensive effort was devoted to the collection and analysis of these types of data during the study. Such data provides an effective means for assessing the overall training capability of the industrial complex. It indicates not only the training capability within industry but also that industry, like the Navy, is required to provide training to many employees in many occupational fields. For example, some firms annually invest $275,000,000 to provide 20,000,000 student training hours to an employee population of 260,000. This represents an average of 77 training hours per employee or 3.8% of the total productive time. Industrial organizations were contacted which maintain over 2,000 courses in the vocational, technical, social and management field. An extensive training capability is required to maintain training programs of these magnitudes.

Generally speaking, industry has the capability to provide training for everyone, from pre-employment preparation to pre-retirement courses, for the unskilled seeking a trade, to the manager seeking an executive position. The most common types of industry training programs include:

(1) Professional training

(2) Vocational training

(3) Apprentice training

(4) Craft training

(5) Retraining

(6) Management training

(7) Executive training

(8) Training for unemployables

The most common industry training programs are those designed for the rank and file employees. This category includes craft, apprentice, skill and retraining programs. Apprentice training, for example, is the traditional preparation for skilled craftsmen. There are approximately 50 crafts with well established apprenticeship requirements. Approximately 200,000 registered apprentices are being trained in various crafts throughout the country.

Another facet of industry training is that provided for the "unemployables" or "hard core" unemployed. These training programs are designed for those who cannot qualify for admission to job training or apprentice training programs. Many such programs are supported by federal funds. The training techniques used by industry for this type of training have potential application to training for Category III and IV Navy personnel.

The observations presented below summarize the major study findings regarding industry training capability:

(1) The industrial complex has the capability to provide training in all vocational, craft and professional fields, and indicates a desire to provide Navy training if requested. The cost-effectiveness of such training has not been determined. Furthermore, contract training with industry requires careful matching of training requirements with specific industry source capability.

(2) Most industrial organizations have well established internal employee training programs. These organizations provide training whenever

and wherever the need is evident or anticipated and have therefore established excellent training capabilities. There are some organizations, normally small in size, which have no internal training capability and therefore procure their employee training.

(3) The trend in industry is for management to propose and maintain extensive training opportunities for employees in a variety of occupational fields.

(4) Public policy will apparently continue to increase the need for education and training in industry and in the public sector. This is primarily due to the evidence which supports the economic significance of education and training and the need to keep pace with rapid technological changes.

(5) The American Society for Personnel and Administration conducted a survey in 1967 which indicated that 85% of the personnel managers surveyed reported their greatest training needs to be in the trade and technical fields (Ref. 125). This study indicates that this training need has not changed significantly since 1967.

The industri[illegible] is a virtually untapped resource for Navy skill training. Even [illegible] resource proves not to be cost effective, there are a number of technical, educational, instructional and management concepts utilized in industry which are potentially applicable to Navy training. These concepts, together with the cost effectiveness of industry training, will be explored in-depth in Phase II of this study.

ECONOMIC CONSIDERATIONS. Economics plays a vital role in an organization's training program. This role has changed from a tendency to accept the worth of training at face value to one of equating training to financial payoff. Industry now gives substantial attention to developing means for evaluating training program efficiency from the economic viewpoint. This change in philosophy is due mainly to industry's acceptance of the "human resource investment concept."

The issue of economic considerations used in industry training programs is addressed with respect to techniques, concepts and philosophies. Data such as industry training program development costs, hardware costs, student cost per hour and the TAEG developed training cost model are presented in Section VII.

Industry, like many Government activities, approaches the issue of training costs from different viewpoints. The organizations which develop long range educational strategies and plans normally have the most efficient training programs. These long range plans are required to justify the high development costs of modern instructional technology and must be traded off against clearly defined savings in future years of utilization. This is accomplished through the application of the concept of cost-benefit and cost-effectiveness analysis.

The concept of cost-benefit and cost-effectiveness analysis is used throughout industry as an effective tool to choose, justify and implement the many training alternatives available. Many of the new economic approaches now being applied to training were influenced by this concept.

When using cost-benefit and cost-effectiveness analysis, it is important to avoid the tendency to oversimplify the criteria to be considered and underestimate the importance of other criteria. The most common errors experienced in applying this concept to training are:

(1) Emphasis placed only on cost criteria (i.e., cost per student per learning hour),

(2) Quality of training placed above all other criteria,

(3) New instructional techniques and hardware emphasized purely for the sake of "newness," regardless of cost or quality.

Application of cost-benefit and cost-effectiveness analysis to computer based instructional systems presents unique problems to the analysts. Industry experience indicates that the problem should always be approached with the clear intent of developing a more effective instructional system prior to installation of equipment. Experience further indicates that it is difficult to cost justify a computer based system such as CAI and CMI when the terminal serves as the primary presenter of information. Normally, offline presentation through text, audio/visual or other self study devices (i.e., CMI) is more cost effective than presentation of a majority of the material by the terminal (i.e., CAI).

Although cost-effectiveness and cost-benefit techniques are used effectively in industry to combat rising training costs, they are not the only techniques for solving every instructional problem. Industrial organizations apply certain basic philosophies, depending on the environment, to effect cost savings. For example:

(1) Cost reduction may be achieved in large enrollment courses when it is feasible to accelerate the progress of the more able learner.

(2) Cost savings may be achieved in remedial training when instructional effectiveness can be increased without a significant increase in cost.

A significant study finding was that *all* training costs, such as the costs of course development, maintenance, student travel, instructor time and facilities, must be included when comparing training alternatives. The *true* cost of a training program cannot be determined unless these costs are considered. Furthermore, costs should not be analyzed strictly from a current year standpoint; they should take into account future considerations. These considerations are not generally recognized by industry or by many government activities concerned with training. The discussion of the training cost model in Section VII further supports these findings.

Most industrial organizations agree that increased learning effectiveness can justify the additional expense of an instructional system if this effectiveness results in reduced training time, increased job productivity or reduced support costs. It is not difficult to design a high cost training program that is effective within a given framework; however, it may be very difficult to design a low cost training program that would be equally effective.

The high cost of training has forced industry to seek new techniques to improve the effectiveness and efficiency of training. Many of these new techniques, particularly in the area of training cost analysis, have application to the Navy. Another factor, pertinent to the subject of training economics and commercial contract training, is the requirement of NAVMATINST 4860.12A which states in part:

> "Generally an in-house operation should not be approved unless costs of in-house performance will be at least 10% less than costs of obtaining the product or service from a commercial source."

It is difficult to determine if this policy is being complied with unless a standardized training cost technique is established for both industry and government. This issue requires additional consideration during Phase II of this study.

FACILITIES. Industrial training facilities are of interest to this study for two reasons. First, they serve as an indicator of training capability and second, the trends in training facility design may have application to Navy training facilities.

Recent advancements in education and training have influenced progressive changes in the approach to training facility design. These changes were urgently required as past training facilities failed to meet current and projected training needs. Industry now advocates progressive training facility designs with emphasis placed on facility flexibility and a suitable learning environment for the student. Advantages include:

(1) Increased training effectiveness

(2) Increased flexibility for modification

(3) Reduced facility modification costs

(4) Increased capability to meet the future training needs of the organization.

Application of the systems approach to training facility design is a relatively new technique used by certain industrial organizations. Information relative to expected facility size, type, composition, duration of classes, equipment and special requirements is coded for computer input.

From analysis of computer output it is possible to make a determination of organizational requirements and alternative facility designs.

Industrial organizations have made effective application of the systems approach, modern architectural designs and new construction techniques and materials to create a pleasant student learning environment within their training facilities. There are many cost effective design techniques used to create this environment while simultaneously increasing instructional effectiveness and facility flexibility. These include:

(1) Modular panels

(2) Acoustical screens

(3) Precast concrete slabs

(4) Common projection booths

(5) Turntable stages

(6) Instructor classroom controls

(7) Media centers

(8) Student study centers

The emphasis placed on the student environment to enhance learning and on planning for the future by incorporating flexibility design features in new training facilities is a significant study finding. Serious consideration should be given to application of industrial training facility concepts to the design of Navy training facilities. Whereas initial costs may be higher than conventional designs, the savings in future revision costs support the concept of these flexibility design features.

SECTION III

POST-SECONDARY VOCATIONAL TECHNICAL TRAINING

This section of the report presents the findings relating to post-secondary vocational technical training provided by public and private training institutions. Specific issues addressed include the background of vocational technical training, management, accreditation, organizational structure, governing legislation, funding structure, instructional techniques, curricula, training capability, facilities, and other associated considerations. The findings presented herein are based primarily on data obtained through personal visits to the training institutions identified in Table 3.

BACKGROUND. Vocational technical (VOTEC) education is training designed to prepare individuals for employment. Equally important is its commitment to serve the community in meeting the needs of local business, industry and society.

There has been a tremendous growth and proliferation of VOTEC training over the past decade. The National Defense Education Act of 1958 and the Vocational Education Amendments of 1968 provide funding and Federal/State cooperative efforts to expand education into the occupational fields.

This activity is a reflection of the widespread recognition of the urgent need for technically trained personnel, in a wide range of skills, within all sectors of the economy. The development of this requirement has been accompanied by a steady increase in status and financial rewards for technically skilled workers, and by improved instructional techniques and facilities for teaching modern technologies. Government and industry at all levels have cooperated with educational agencies to provide maximum development of training capability in the vocational fields.

There are more than 20,000 institutions in the United States, employing some 200,000 instructors, offering VOTEC training. The 2,000 area vocational schools are increasing at the rate of 125 per year. Approximately two billion dollars a year are spent on vocational education.[4]

The primary criterion for the selection of VOTEC institutions for evaluation by this study was their closeness to existing Navy installations. The training capabilities of these institutions were evaluated on the basis of their physical facilities, design and presentation of curricula, and other determinants relating to good educational practice; i.e., personnel qualifications, instructional techniques and media, school management, and program development.

DISCUSSION. The operational and administrative management of public VOTEC schools is determined by the individual states, and there are considerable differences among them. In general, however, each state retains final authority and financial controls over local programs but allows considerable autonomy at local levels in meeting community needs.

Consideration in this study is directed primarily toward post-secondary institutions; however, there are examples of excellent schools which provide VOTEC training to both high school and adult students and are quite capable of meeting certain Navy training needs; therefore, certain of these schools were included in the study.

Post-secondary VOTEC institutions fall into two general categories: private and public. Private schools include trade and technical schools which are operated as commercial enterprises. They offer training in many technical and business areas, including auto and diesel mechanics, welding, data processing, electronic technician, stenography, health related occupations, and the like. A convenient list of such enterprises is found in the Directory of Accredited Private Trade and Technical Schools of the National Association of Trade and Technical Schools (NATTS).

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[4] 1971 DIGEST OF EDUCATIONAL STATISTICS

Private VOTEC schools are subject to state regulation, but many are not subject to the rigid requirements of such organizations as the NATTS or regional associations of colleges and schools. There are many varieties: correspondence schools, one-room shops for teaching a single skill, elaborate data processing institutes, and up to 4-year degree-awarding business colleges. A few private junior colleges offer some occupational training, usually in business and clerical skills. Due to this wide variation in private schools, each must be considered on its merits.

While many private VOTEC schools are capable of providing high quality training for Navy personnel, and have done so frequently in the past, they usually have less elaborate facilities for instruction and more costly schedules of tuition and fees than the public institutions.

Public VOTEC institutions have a variety of forms, depending upon the states concerned. Some technical high schools have adult programs; the area vocational schools are primarily post-secondary but may serve some high school students. Community/Junior Colleges may be the sole source of post-secondary VOTEC training in some states, or may share the training with area vocational technical schools in others. South Carolina has 26 technical education centers throughout the state, as well as area vocational technical schools and branches of the University system in several cities.

Most VOTEC institutions offer certificates of completion, but some merely award a diploma for course completion. Community/Junior colleges and some technical institutes offer associate degrees in addition to certificates. Credits achieved can often be transferred or applied to 4-year degree work.

The most reliable standard of quality in public VOTEC institutions is accreditation by the appropriate regional association of colleges and schools. All of the institutions considered in this study were either accredited or were in candidate status for accreditation. Affiliation with or recognition by professional associations reflects approval of the training program.

State certification requires a comparison of course curricula and school administration with established state criteria. Trade, professional, or union groups may serve as certifying organizations.

Most VOTEC institutions are assisted in curriculum development by advisory committees. These committees include representatives of management, labor, employers, professional practitioners, civic leaders, public employment services, scientific and technical associations and societies, and other specialists. The function of the committee is to identify employer needs, potential training population, determine skill level desired, scope of training, assist in locating instructors and equipment, job placement, and provide feedback on performance of trainee and course revision.

The management and faculty of accredited schools meet state certification requirements for their positions. Normally, a VOTEC instructor must be a high school graduate and meet stringent experience and competency requirements. Many instructors hold bachelor's and advanced degrees and/or many years experience as journeymen. Community colleges usually require a bachelor's degree as a minimum plus work experience.

Since the purpose of VOTEC training is to prepare individuals for an occupation, the curricula are predominantly "hands-on" and "need-to-know." Only such theory and academic elements required for the skill being taught are included. Individualized, self-paced instruction is being emphasized by many of the institutions, and is forecast for others. The typical VOTEC instructor works very closely with small groups, providing constant observation of, and assistance to, each trainee.

There are four basic concepts used in the selection of instructional techniques and media in vocational education. They are:

1. The measure of effectiveness in reaching each instructional goal.
2. The flexibility of decision within the constraints of available funds, facilities, equipment, student load, and instructor capability.
3. The role or purpose of experience.
4. The level of student comprehension and discriminate abilities (conceptual and physical).

The instructional procedures, media, and material available to vocational schools are numerous. They include simulators, self-instructional demonstrations and field trips; motion pictures, television, filmstrips, transparencies, disc and tape recordings; and the graphic media of charts, graphs, diagrams, maps, and cartoons; and the written and spoken word.

A recent trend in VOTEC schools is in the modular instructional units, allowing open enrollment at almost any time. The student then proceeds at his own pace, utilizing individualized materials and media, along with workshop activities, to complete the course of training at his best speed.

Vocational-technical educators frequently use mockups and working models to enhance familiarization and skill development. There is a trend to use simulators to provide the development of manipulative skills.

Until recently, the shortage and obsolescence of facilities presented serious obstacles to the development of vocational education. Partially to remove these obstacles, Federal Education Acts included financial support for the construction of area vocational facilities. This assistance, added to state funds, defrayed the costs for new construction and for remodeling and expansion of existing facilities. Additional sources for construction funds were included in legislation passed in 1958, 1963, 1965 and 1968. The impact of this legislation is exemplified by the fact that the number of area vocational schools in the nation increased from 405 to 1303 in a four-year period. In a one-year period, 345 construction projects were funded by Federal, state and local governments for a total of $307,000,000.

The trend in vocational institution facility design is toward modern architecture, planned for functional use, ease of maintenance and cost effective construction. Administrative and instructor offices, as well as student recreational and study areas, are designed for privacy and utility. Storerooms provided for instructional equipment are contiguous to the classrooms. Realism to the work environment is a basic consideration in facility design. Usually, buildings are air-conditioned, except for some shops such as auto mechanics and aircraft maintenance, where enclosure may be impractical or unsafe without special provisions.

Accredited instructional facilities meet the appropriate state and federal regulatory requirements for fire, safety, and sanitation standards. Adequate library facilities and resource centers were evident in the schools surveyed. Library facilities must meet minimum standards to achieve accreditation in terms of volumes contained and reference material associated with the technical fields. Learning centers are usually located adjacent to libraries and equipped with individual study carrels designed for the use of such devices as microfiche readers, video tape units, sound-slide machines, and other similar self-paced or programmed instructional equipment and materials.

Public school finance records are a matter of public record and are available for examination through each state Office of Education as well as the U. S. Office of Education. Annually, the U. S. Office of Education publishes a compendium which describes the school finance system of each state. The following data illustrates expenditures by the Federal, state and local sources for a period of one year:[5]

FUNCTION	EXPENDITURE
Facilities	$ 216,635,081
Equipment	69,299,284
Instructional Material Development	7,709,925
Personnel	1,056,645,719
Supplies	18,466,514
	$1,368,756,523

DISTRIBUTION	
Instructional Development	1%
Supplies	2%
Equipment	5%
Facilities	15%
Personnel	77%

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[5] Tables C and F, Vocational Technical Education Annual Report, Fiscal Year 1969

SUMMARY. Throughout the United States, hundreds of vocational schools, technical institutes, and community colleges have been established and expanded, incorporating the construction features of complex modern facilities specifically designed for vocational training.

As an integral part of the community, the Navy's shore-based training facilities have the opportunity to participate in, and capitalize upon, these excellent training facilities. Such involvement represents the opportunity to effectively expand Navy training capability by providing a variety of technical training programs to extend or supplement present Navy training, to eliminate costly duplication of existing civilian facilities, and to provide specialized training not offered by Navy schools. Most civilian institutions contacted appeared receptive to this concept.

The capability of these vocational training institutions to provide training for Navy personnel is supported by observations made during this study. (This is addressed in Section V.) To determine the suitability of any specific institution to provide training, a number of variables have to be considered in each case. These variables include:

- The site of training; the distance from the Navy training center concerned, its accessibility, and the time required to reach it.
- Navy required courses offered by the institution, and their degree of comparability to Navy requirements.
- Physical facilities of the institution available for the conduct of Navy training.
- The capability of the institution to train the desired number of students in a given course at a given time.

- The institution's requirements for minimum and maximum student input, and regularity of input.
- Accreditation of the institution; recognition by academic, trade, and industry groups.
- Time frame of instruction; length of course(s), and hours of attendance.
- Tuition, fees, cost of books and supplies.
- Flexibility in adaptation of training to Navy requirements; e.g., course content, use of GFE (Government Furnished Equipment), and course compression.
- Facilities for messing, learning resource center, individualized and remedial instruction.
- Instructional methodology; use of training aids, equipment, and media.

From the above factors, determination can be made of the institution best qualified to instruct each of the Navy-required courses.

Vocational training provided by the civilian sector has a definite place in the military educational system. If the civilian community can provide skill training at an acceptable level of competency, the armed forces should take advantage of an existing system rather than duplicate it.

SECTION IV

SELECTED NAVY TECHNICAL PROGRAMS

This section of the report is concerned with Naval training programs and facilities under the cognizance of the CNET for enlisted ratings, and addresses the skill training programs selected for the purposes of this study.

CNET training encompasses a wide range of skills designed to meet the manpower requirements of the Fleet, with exceptions primarily in the areas of Navy air and the medical field. Schools are located at 14 Naval bases; however, most training is conducted at the San Diego and Great Lakes Naval Training Centers.

FACILITIES. The majority of training schools at the Navy Centers are located in permanent buildings which have been in use for many years. Classrooms are generally austerely functional, and lack flexibility in accommodating variations in class size. Few elements of modern instructional design features are represented in the facilities; however, some new construction has been initiated.

Existing Navy schools have an excellent array of operational equipment for training. These resources incorporate a unique collection of shipboard gear and equipment of great instructional value and represent a large capital investment. Deficiencies in procurement of the more recent systems introduced to the Fleet have necessitated continued use of older, semi-obsolete models for training in some instances. Utilization of local civilian vocational schools with modern training equipment could alleviate Navy investment in many types of equipment now procured for training.

The EM/IC (Electrician's Mate/Interior Communications Electrician) School, Great Lakes Training Center, is representative of Navy technical training schools. The facilities, although not new, are of more recent construction than many of those in use. The EM "A" School, IC "C" School and administrative facilities are contained in two buildings. The EM "A" School features standard commercial equipment. Navy specialized gear and mockups, such as shipboard lighting systems, are also utilized.

The EM/IC "B" School (30 weeks in length) is conducted jointly for the first 20 weeks, then 10 weeks of separate training is provided for EM's and IC's. The typical trainee is a 3rd Class Petty Officer on his second enlistment, with five to six years service.

In the separate phase of IC "B" training, the equipment used is primarily representative of specialized Navy shipboard systems. Such equipment will not normally be found in civilian institutions, unless provided as GFE (Government Furnished Equipment).

The IC "C" School provides specialized training in four areas: electrical gyros, mechanical gyros, automatic telephone and closed circuit television. Classrooms and labs include shipboard components, mockups and operational gear representative of that used aboard ship.

The Machinist Mate (MM), Engineman (EM), and Boilerman (BT) Schools are being combined into a "Propulsion Engineering" School at Great Lakes and represent training which requires extensive and costly training facilities and equipment. This complex occupies several large buildings, including machine shops, metal-working equipment, a 600 psi steam lab, a 1200 psi steam lab currently under construction, and a wide assortment of components of great size and weight used for instructional purposes.

PERSONNEL. Personnel requirements for Navy Training Centers are extensive and include instructional, administrative and support specialists. Staffing includes instructional supervisors, curriculum specialists, equipment maintenance personnel and other support personnel. Approximately 1100 personnel are required to operate the Great Lakes Training Center which has an average student population of 5400. This represents an approximate student to support personnel ratio of 5:1.

Instructors are selected for their skill and experience in the various technical fields being instructed, and are usually graduates of a five week instructor school operated by the Navy. Reassignment as an instructor represents shore duty, and is subject to periodic rotation, rather than career progression. Although instructors are screened for instructional ability, they are primarily technical specialists, a situation conducive to uneven quality of performance as instructors.

The customary instructor teaching schedule is based on 25 contact hours per week, including both classroom lecture and lab/shop activities. The instructor/student ratio in lecture presentations is approximately 1:25 but may be considerably lower, 1:5, for laboratory or shop work. Instructor utilization rates are somewhat uneven, due to variations in course offerings and student input. The average pay grade for instructors is E-6 or E-7, and the normal assignment is for a three year period. Instructors are often returned to instructional assignments after periods of sea duty. Periodic evaluations of instructor teaching abilities, knowledge, and technical skills are conducted by supervisory personnel, usually E-8's.

COURSE DEVELOPMENT. Navy schools are in the process of developing task analysis as the first step in training system design. Individualized, selfpaced instruction is emphasized. The training courses thus developed utilize programmed text, student handouts, sound/slide presentations, super8 films, shop work and laboratory.

Course materials have traditionally been developed, tested and revised by instructors, with coordination between centers and review and approval by higher command headquarters. Customarily, the selection of an instructional approach has been dictated by expediency rather than considered planning.

In the Navy, task elements are expressed as learning objectives, which provide the structure for guiding and evaluating the courses. The Navy is beginning to use professionals to conduct task analysis.

SELECTED NAVY RATINGS. Twelve Navy enlisted ratings were selected for this study on the basis of their considered comparability to civilian skills and, in most instances, relatively low annual student input. The entry level of skill training was selected for analysis, as this stage of training would incorporate basic technologies common to both military and civilian skills. Forecast training requirements for the selected ratings are shown in Table 6.

These selected ratings and the locations of existing Navy technical training schools are as follows:

1. ELECTRONIC TECHNICIAN (ET).....GREAT LAKES; SAN DIEGO; TREASURE ISLAND
2. DATA SYSTEMS TECHNICIAN (DS)...MARE ISLAND

TABLE 6. FORECAST TRAINING REQUIREMENTS FOR SELECTED RATINGS

RATING	STUDENT INPUT				
	FY75	FY76	FY77	FY78	FY79
YEOMAN "C" (YN)	31	2	8	11	11
LITHOGRAPHER "A" (LI)	60	63	61	61	61
MACHINERY REPAIRMAN "A" (MR)	693	715	714	714	714
ELECTRONIC TECHNICIAN "A" (ET)	3302	3598	3574	3574	3574
DATA SYSTEMS TECHNICIAN "A" (DS)	396	385	389	389	389
INSTRUMENTMAN "A" (IM)	77	58	44	74	44
YEOMAN "A" (YN)	1558	1635	1690	1690	1690
JOURNALIST "A" (JO)	141	146	148	148	148
COMMISSARYMAN "A" (CS)	1965	1985	1950	1950	1950
ILLUSTRATOR DRAFTSMAN "A" (DM)	28	34	36	36	36
ELECTRICIAN'S MATE "A" (EM)	2445	2429	2397	2397	2397
ENGINEERING AID "A" (EA)	110	88	89	89	89
EQUIPMENT OPERATOR "A" (EO)	475	475	489	489	489
STEWARD "A" (SD)	235	235	235	281	521*

* - Unofficial estimate

3. INSTRUMENTMAN (IM)..................GREAT LAKES
4. YEOMAN (YN)..........................SAN DIEGO; ORLANDO
5. JOURNALIST (JO)....................FT. BENJAMIN HARRISON
6. COMMISSARYMAN (CS)..................SAN DIEGO
7. LITHOGRAPHER (LI)..................(NO FORMAL TRAINING)
8. ILLUSTRATOR/DRAFTSMAN (DM).........(NO FORMAL TRAINING)
9. ELECTRICIAN'S MATE (EM)............GREAT LAKES; SAN DIEGO
10. ENGINEERING AID (EA)................PORT HUENEME
11. EQUIPMENT OPERATOR (EO)............PORT HUENEME
12. STEWARD (SD)......................SAN DIEGO

As indicated, Lithographer (LI) and Illustrator/Draftsman (DM) have no formal training programs; award of these ratings is based upon background, aptitude, previous experience and on-the-job-training. Yeoman (YN) "A" training, with the exception of the typing requirement, is principally concerned with Navy regulations, correspondence, forms and procedures unique to the Navy. Most of the curricula for the ratings listed above include a small percentage of subject matter and/or equipment unique to the Navy. It is anticipated that civilian institutions could modify existing curricula to accommodate such Navy unique requirements.

The following paragraphs provide a review of training for the selected ratings ("A" School level unless otherwise indicated).

1. Electronics Technician (ET). This training is offered at Great Lakes, San Diego and Treasure Island. The length of the training course is 13 weeks. The training includes: theory of electronics;

application of electronics to radar; theory of direct and alternating current; electronic test equipment utilization; characteristics of ultra-high and super high frequency; and antenna operation and repair. The annual student input ranges between 3300 and 3600 students.

2. Data Systems Technician (DS). This 42 week training course is offered at Mare Island, California. The prerequisite for the course is six weeks of basic electricity and electronics. The training course includes: basic electricity and electronics; electronic digital computing; theories and principles of data storage; and maintenance of electronic digital systems. Input is approximately 400 students per year, with a class of 16 beginning each two weeks (25 classes per year). The attrition rate is approximately 10%.

3. Instrumentman (IM). This 17 week course is offered at Great Lakes. The course of training includes: fundamentals of physics applicable to instrument repair; operation of mechanical instruments; use of lubricants and corrosion preventatives; cleaning solutions and solvents in instrument repair and maintenance; and repair and maintenance of office machines, mechanical instruments, watches and clocks. Input is approximately 76 students per year with an average on-board student load of 37 (FY 74).

4. Yeoman (YN). This training is offered at San Diego and Orlando. The course length is seven weeks, with 25 classes conducted each year. The annual input is: San Diego 746, Orlando 302, for a total of 1048 students per year. The course of training includes: typewriting; classified material; correspondence and filing; service records and personnel administration; and legal records and procedures.

Yeoman "C" training was moved from Orlando, Florida and is now offered at Ft. Benjamin Harrison. The course is 14 weeks in length and includes 489 hours of shorthand to obtain proficiency of 90-110 words per minute, 80 hours of English grammar, 35 hours of typing, and 30 hours of administrative procedures. The annual student input is 63 students.

The Yeoman "C" school is housed in a building with seven classrooms and office space. Army, Air Force and Navy students are instructed here. The Navy provides one instructor who shares office space with Army instructors and support personnel. Spaces for student self-study are lacking, due to double shift classes.

5. Journalist (JO). This 10 week training course is offered at Ft. Benjamin Harrison. Classes average nine students and begin every two weeks for an annual input of approximately 145 students. The course of training includes: principles of successful public relations; press ethics and libel law; techniques of designing and printing artwork; organization of radio and television networks; production of radio and television programs; photographic techniques; engraving and printing process; and newspaper and press-wire operations.

6. Commissaryman (CS). This training is offered at San Diego. The training course is eight weeks. There are 50 classes per year, with an annual student input of 1051. Input per class is 21 students per week, with an average of 168 under instruction at any one time. The course of training includes: preparation of meats, soups, vegetables and desserts; baking bread, pies and cakes; cutting of meats, fowl and fish; avoiding waste in food preparation; and working with frozen meat. Commissaryman and Steward courses are combined until the last phase of training which consists of 90 hours (3 weeks) of specialized training.

7. Lithographer (LI). Advanced courses are offered at Mare Island and Great Lakes. The annual training requirement for this rating is 60 to 63 students. A 30 day course for Lithographers has been proposed by the Navy Publications and Printing Service (NPPS) Branch Office, Orlando Training Center with the following curriculum:

a. Composition: typewriter; varityper; headliner; hand lettering; artwork; and letterpress.

b. Negatives: chemicals and materials; negatives; positives and paper prints; enlargements/reductions; opaquing; stripping; filing and retrieving; and deflat/reflat operations.

c. Plates: metal; paper; and compatibility of materials and chemicals.

d. Printing: 10"x15" offset; and 17"x22" press.

e. Collating: hand and machine.

f. Finishing: folding; drilling/punching; stapling; and padding.

g. Copying machines: Xerox.

h. NPPS Support: seminar.

i. Text for course: Lithographer's Manual

The principal instruction required is:

a. Process photography

b. Lithographic platemaking

c. Offset press operation

d. Reproduction equipment repair

8. Illustrator/Draftsman (DM). The annual training requirement for this rating is 28 to 36 students. When in operation this school

offered a 15 week course in the development of basic drafting skills; machine and freehand illustration; methods of effective representation; and instruction in various media and techniques for charts, graphs, posters, cartoons and other illustrations work. Training for this rating requires instruction in the fundamentals of drawing and composition; commercial art techniques; freehand perspective drawing; theory and use of color; photo retouching; and principles of offset and letterpress.

9. Electrician's Mate (EM). Training for this rating is provided at Great Lakes and San Diego. The length of the course is 12 weeks at both locations. Current annual student input is 2425 (Great Lakes 1625; San Diego 800); forecast is for 2397 to 2445 students per year. San Diego conducts 50 classes per year with an average student input of 15 students per week. The average number of students on board at Great Lakes is 396, and 168 at San Diego. The course of instruction includes: fundamentals of DC and AC electricity; fundamentals of electrical equipment; soldering electrical connections; blueprint and electrical print reading; electrical measurements; maintenance and repair of AC and DC generators, motors, and controllers; operation and maintenance of power and lighting systems; and mathematics as it applies to electricity.

10. Engineering Aid (EA). This training is offered at Port Hueneme. The length of the training is 14 weeks. The annual training requirements range from 88 to 110 students. The course of instruction includes: review of mathematics; materials testing of soils, asphalt and concrete; basic drafting; and basic surveying, topographic surveying, and building layout.

11. Equipment Operator ([illegible]O). This training is offered at Port Hueneme and Davisville. The length of the training is 12 weeks. The annual training requirements range from 475 to 489 students. The course

of instruction includes: basic mathematics related to equipment operation; basic principles of internal combustion engines; fundamentals of earthwork and equipment production; and the operation, adjustment, and servicing of hauling, loading, lifting and ditching equipment.

12. Steward (SD). This training is offered at San Diego. The length of the training course is 8 weeks. The annual input is 816 students, with 50 classes per year and an average of 128 students on board at any one time. The weekly input is 16 students. The annual requirements forecast for this rating range from 235 to 521 students. The course of instruction is the same as for the Commissaryman, except for the last three weeks which covers: Naval Officers' uniforms, ranks and devices; organization of private messes; wardroom services; pantry, stateroom and B.O.Q.; large mess operation; and laboratory galley phase.

COMMERCIAL TRAINING CONSIDERATIONS

Navy "specific factors" must be considered when comparing Navy and civilian training programs. "Navy specific" training pertains to the development of specialized skills and knowledge in procedures and equipment unique to the Navy.

As mentioned previously, Yeoman "A" training is heavily Navy specific in content while Yeoman "C" training is basically a course in shorthand and English, with only a small percentage of the course devoted to Navy-unique subject matter. It is emphasized that the other eleven ratings do, in some cases, have Navy specific training requirements which would have to be incorporated into the curricula of the commercial source.

Study findings indicate that civilian institutions can be used to provide effective training to Navy personnel in appropriate entry level skills. Furthermore, course prerequisites for both the Navy and civilian institutions are essentially the same and civilian institutions indicate a willingness to provide Navy training. The major drawback in civilian programs is the lack of Navy-specific training; however, this requirement can be met through the modular approach. By modularizing training so that the Navy-specific information is concentrated after the basic skill development, more objective comparisons to civilian programs can be made. Standard commercial equipment could be used for instruction in the basic skills, such as theory, and operation and maintenance, to be followed by a relatively short phase relating to Navy-specific equipment. In addition, the majority of vocational/technical institutions and community colleges expressed interest in providing instruction for the Navy and are willing to modify curricula to meet specific Navy requirements. These and other factors are discussed in Section VI of this report and will be subjected to in-depth analysis during the Phase II portion of this study.

SECTION V

EVALUATION OF TRAINING CAPABILITY

INTRODUCTION. This section is concerned with a comparative assessment of the capabilities of commercial sources to provide training in basic skills for the Navy. The assessment includes physical facilities, curriculum design and presentation and other determinants such as cost-effective procedures, efforts toward course compression, and flexibility in meeting Navy student attendance requirements. Assessment variables include:

1. Size and design of instructional facilities
2. Planned or potential improvement of facilities
3. Qualifications of course developers and instructors
4. Use of systems approach to training
5. Use of performance based objectives
6. Post-instructional evaluation of trainees
7. Cost-effectiveness
8. Training effectiveness

FINDINGS.

I. Industry

In general, industrial organizations in the United States (and abroad) are engaged in training activities on a very large scale. Facilities range from a few classrooms to major complexes of many buildings. Many of these organizations have extended their training activities to outside clients, offering package courses either at their own facilities or at those of the customer. Many of these organizations are interested in providing training for Navy students.

The variance in facilities is also characteristic of course design and development. The large industries generally allocate a large portion of their budget to the operations of training programs which will prepare the worker for specific task performance. These programs usually include the full range of advanced instructional concepts and techniques, with utilization of the most effective media and equipment. As noted in Section II, many industrial organizations are using, and developing, progressive education and training techniques and equipment to improve training efficiency and effectiveness. Conversely, some industrial organizations use conventional methods and traditional techniques, with basic facilities, and achieve creditable results.

Generally speaking, industry has the capability to provide training in all basic skills. Navy related skills currently being taught in industry include automotive mechanic, telephone installation and repair, shop skills, electrical and electronic technician, computer technology, photography, graphic arts, and many others. Excellent management and supervisory training is also available. A summary of the training activities of the industrial organizations investigated is provided in Appendix C.

II. Private Trade Schools

These schools are commercial enterprises and therefore operate on a profit making basis. They offer training in a variety of skill areas; however, tuition and other costs are normally significantly higher than that of comparative public institutions. The Navy and Marine Corps have contracted with private trade schools for a number of training programs, and in some cases the costs have proven competitive. Exact costs can only be determined through negotiation for a specific program.

It is difficult to generalize regarding the facilities of these schools, since they vary widely. Due to lack of public subsidies, their facilities are usually modest and provided with the minimum equipment required for instruction.

Course development and quality of instruction must be determined on an individual basis as these schools are not subject to the vigorous accreditation procedures of the regional associations of colleges and schools. Guidance can be obtained however from other certification sources, such as trade and industrial organizations and Federal agencies. Moreover, they are motivated to achieve employer approval of trainee output as a matter of successful business practice.

The advantages of private trade schools lie in their need-to-know, hands on, technical training methods, their flexibility in establishing attendance schedules for Navy classes, and their ability to set up specialized curricula on short notice. The disadvantages may exist in less adequate facilities, more limited training programs, variations in quality of curricula and instruction, and higher costs.

III. Private Post-Secondary Schools and Colleges

These institutions include private junior colleges, with primarily academic, liberal arts curricula, and some colleges of business, usually accredited by regional associations of colleges and schools. Few of these schools were included in the study due to the lack of technical skill offerings, and higher costs due to lack of public subsidies.

IV. Public, Post-Secondary Vocational-Technical Institutions (VOTEC)

This category of commercial training sources includes area vocational-technical schools and community and junior colleges. Designation and functions of these institutions vary from state to state. For example, the principal source of VOTEC training in South Carolina is the Technical Education Centers (TECS); in Illinois, the two-year technical colleges; and in Mississippi, the junior colleges. They all have the function of preparing students for employment and are usually a part of the county (or city) school system, supported by public funds, and offer curriculum leading to certification in technical skill areas with nominal or no tuition. A detailed discussion of these schools is provided in Section III.

The area VOTEC schools, colleges, and institutes inspected in the areas of interest to this study normally consisted of new and modern facilities designed and fully equipped for a wide range of technical training. Some of the smaller area vocational schools have more modest facilities, but these are generally modern and well designed. Labs and workshops are comparatively well-equipped for training.

Area VOTEC schools provide specialized occupational training in a variety of skills. Community and junior colleges and institutions, however, offer academic, college transfer, pre-engineering and specialized programs in addition to technical skill training. Most community and junior colleges and institutes offer technical skill training to a level well above that required for Navy "A" school graduates. On the other hand, the "apprentice training" of area VOTEC schools is closely related to "A" school training. In most cases, all of these institutions provide excellent training.

Course design and presentation is a major concern to VOTEC schools. The curricula are prepared to reflect the actual needs of the clients -- usually local industries. As discussed in Section III, the use of advisory committees, with which the subject matter specialist maintains close contact, is a standard procedure of VOTEC schools. Course revision is a continuous process, with rapid response to changes in task performance or in technical modifications as reported by employer-members of the advisory committees. This procedure has merit in meeting Navy training needs, since Navy training would benefit from development of package courses in fulfillment of military requirements.

Most VOTEC school instructors are journeymen in their trade who are selected for their ability to teach. Their instruction technique is normally "hands-on" and only that theory which is "need-to-know" is presented, usually in classrooms adjoining the workshops. Trade experienced instructors provide an enthusiasm and practical approach resulting in increased student response above that accorded to strictly academically qualified teachers.

Normally, VOTEC schools can utilize selected courses or provide package courses to meet Navy training requirements. Many of these schools are prepared to conduct training on a full-time, 40-hour-per-week basis, within specified time frames. Furthermore, some schools will accept a student for training at any time and allow him to complete the training at his own pace over a period of six months to a year. Others, however, are on conventional term, semester, or quarter-hour schedules, which would require modification to allow participation by the Navy.

Voluntary accreditation is the primary element of quality control in education. Although accreditation infers excellence, it should be understood that the procedure is based upon minimum standards, not necessarily standards of excellence. Generally speaking, however, accreditation provides a convenient basic standard for consideration of public VOTEC schools as a source of Navy training. All of the public institutions included in this study were either accredited or in candidate accreditation status.

V. Commercial Training Evaluation Factors

The previous discussons have dealt with the assessment of the training capabilities of the types of commercial sources included in this study. From these discussions, it is apparent that there are certain basic factors which must be considered and evaluated in considering the utilization of commercial sources for Navy training. These factors are:

1. Location. The training source should be located near a Navy base, otherwise the cost effectiveness of such a program would be adversely affected by the costs of transportation, billeting, messing, and support. Most of the industry organizations reviewed were not near the Navy installations included in this study. Public and private VOTEC institutions, however, were located within commuting distance of all Navy installations considered.

2. Costs. The cost of industry and private trade school training, which incorporates the development or modification of training programs, plus a profit factor, is generally considerably higher than that of Navy schools and of the VOTEC schools.

3. Curricula and Facilities. Each training source, whether industrial organization or public or private training institution, would require inspection and evaluation to determine its capabilities, quality of instruction and facilities, and types of training.

4. Accreditation. Industrial organizations are not usually accredited by the regional associations of colleges and schools, whose requirements are rigorous; however, some skill areas are certified by trade, union, or industrial associations, and in some cases by state and Federal agencies. Evaluation of course quality is often, therefore, a value judgment.

5. Instructional Staff. The proficiency of instructors varies greatly between types of commercial sources, and within a specific type of commercial training source. Industry skill instructors are, in many cases, journeymen workers with little background in instructional technology; therefore, the level of expertise may be uneven. On the other hand, VOTEC skill instructors are normally subject matter experts and must meet rigid educational and training requirements. Qualifications of instructional staff, therefore, require evaluation.

The factors discussed above are minimum considerations which must be addressed in selecting a commercial source to conduct Navy training. The Phase II portion of this study will address these and other source evaluation factors as part of the total effort required to develop a management and implementation plan for commercial contract training.

SUMMARY. The major findings of the assessment of the training capabilities of commercial sources to provide basic skill training for the Navy are summarized below:

1. There are many commercial sources capable of providing Navy skill training; of these, the public post-secondary vocational-technical institutions appear to be the most logical choice in most instances.

2. Private industry has a very large investment in facilities for the development, production, and presentation of technical training. It is very active in applying advanced methods of course design, course compression, and media presentation of technical training.

3. Public technical schools and colleges are undergoing a great proliferation of new and expanded facilities for vocational-technical training, many of which are adjacent to Navy training centers.

4. Curricula offered in public and private training institutions offer a wide range of skill areas, entry levels, performance objectives, and degrees of technical competence.

5. The relationship of civilian to Navy training curricula is closely allied in many skill areas, and civilian sources have considerable experience in adapting their training curricula or developing new training courses to meet user requirements.

6. Centralized curriculum development, with emphasis on cost effectiveness, optimum resource allocation, economic analysis, and long range planning, reflects favorably on many industrial and institutional training organizations. These concepts offer techniques of significant value in training effectiveness for Navy personnel.

7. The expansion in VOTEC technical training institutions has provided a large reservoir of technically skilled instructors and curriculum developers, many of whom are experienced in Navy skills and requirements.

8. In most VOTEC institutions, the selection of instructors and training coordinators has been carefully determined, with wide range recruiting efforts to locate personnel with a high degree of skill and experience. A combination of academic, technical, and practical skills of a high order has been emphasized, rather than purely formal educational backgrounds.

9. The instructional methodology of most VOTEC institutions is oriented toward hands-on training, training in job related environments, in small groups, with close instructor contact. The emphasis is on "need-to-know" rather than "nice-to-know," and necessary academic subjects are expressed in terms applicable to job application.

10. Operational equipment, instructional equipment, and a wide variety of media, representing large investments, are available in many VOTEC institutions for technical training, offering a resource to relieve Navy schools of costly expansion projects.

11. Navy training can benefit from the research, development, and innovative use of sophisticated media and instructional techniques generated within the civilian sector.

12. A number of VOTEC institutions are within reasonable commuting distance of Navy training centers, providing a wide selection of training courses suitable for the instruction of personnel stationed at the centers. The use of buses would allow students to attend classes, yet

continue to remain within the military environment for housing, messing, military duties, and administrative support.

13. Financial support by local, state, and Federal sources permits public VOTEC institutions to offer training at a very low cost to the public. Such favorable fee schedules could provide significant cost reductions in certain Navy skill training programs.

SECTION VI

ANALYSIS OF ARMED SERVICES PROCUREMENT REGULATION

This section of the report presents the study findings relating to the ASPR and its application to the concept of commercial contract training. Emphasis is placed upon ASPR applications, procurement techniques, contractual considerations and related contractual issues.

Previous sections of this study have dealt with the training resources of commercial sources; i.e. industrial organizations and post-secondary training institutions. The ASPR portion of the study considered the appropriate procurement means for acquiring the services of these sources to support and complement Navy training programs. Findings presented herein will be used during Phase II to develop a procurement management and administration plan for commercial contract training.

ARMED SERVICES PROCUREMENT REGULATION APPLICATIONS. The ASPR sets forth the policies, procedures and regulations for all contracts and contractual activities between the Government and commercial sources. The study concentrated on Section XXII of the ASPR. Section XXII sets forth the means of acquiring services through contractual agreements and specifically addresses certain types of contracts which may properly be classified as service contracts. The ASPR specifically designates training and education services as services included in the overall subject of service contracts. Section XXII defines a service contract as "...one which calls directly for a contractor's time and effort rather than for a concrete end product."

Section XXII of the ASPR indicates that "Personal Services" and "Non-Personal Services" fall within the broad definition of service contracts. These two types of services are defined as follows:

1. Personal Services: Personal Services is generally defined as the procuring of services by contract in such a manner that the contractor and/or his employees are in effect employees of the Government. The supervision, direction and control of the contractor or his employees is performed by Government employees.

2. Non-Personal Services: Non-Personal Services is generally defined as the procuring of services by contract in such a manner that little or no supervision of the contractor or his employees is provided by Government employees and the contract may be structured such that a definable project or task is described. Contracts for "Non-Personal Services" represent an approved resource for Department of Defense agencies in the accomplishment of their mission.

Procurement regulations place many restrictions on the procurement of personal services; one of the most restrictive requirements is that a citation of the appropriate implementing legislation be contained in the D&F (Determination and Findings). Other restrictive determinations which must be affirmatively made are set forth in Section 22-205 of the ASPR. Procurement of personal services should be the exception and not the rule.

There are no definite rules for characterizing services as "personal" or "non-personal"; however, criteria for recognizing personal services are presented in Section 22-102.2 and 22-102.3 of the ASPR. The ASPR analysis indicates that it is unlikely that any conflict with personal services contracting would exist in contracting for training services from commercial sources. Those aspects of a true personal services effort are not required for a contract providing for training services. It follows that the restrictive requirements of a personal services contract should provide no obstruction to contract training.

PROCUREMENT TECHNIQUES. Numerous procurement techniques were investigated to determine the most efficient and effective means of procuring training services from qualified commercial sources. These included:

1. Labor Hour Contract
2. Time and Material Contract
3. BOA (Basic Ordering Agreement)
4. Multi-Year Procurement
5. Indefinite Quantity Contract
6. LCC (Life Cycle Costing) Procurement

Labor hour or time and material contracts are appropriate for training programs with fluctuating requirements. The labor hour contract provides for the procurement of services on the basis of direct labor hours expended at specified fixed hourly rates. A time and materials contract is the same except that materials are also supplied by the contractor at cost.

The BOA is an agreement, not a contract, between two parties setting forth general provisions governing orders (tasks) placed against the BOA. Provisions are set forth in the BOA which are applicable to each order placed thereunder. It is appropriate to use the BOA when future requirements are anticipated but cannot be adequately defined or the quantity determined ahead of time. Normally, prices are established prior to performance of the work described in the order; however, exceptions may be made. For instance, when an urgent need exists to commence the effort prior to price agreement, the contractor may be authorized to proceed, with pricing to be derived as soon as practical. Conceivably, a group of distinct and separate BOA's could be negotiated with companies having training capabilities in different skills. Orders could then be placed against the appropriate BOA as training course requirements were received.

The multi-year procurement technique has proven to be very effective in certain types of procurement situations. The primary objective of multi-year procurements is to reduce costs which occur as a result of repetitive procurement and expensive administration. It is most effective in situations where all future requirements and quantities are known, which, unfortunately, is not always the case with training requirements. It is essential that the total requirements be established early when using the multi-year procurement approach. If this cannot be accomplished, the attractiveness of the approach diminishes. This does not eliminate multi-year procurement as a technique for procuring training services. It could be an excellent method if realistic training requirements could be estimated and the scope of work remained reasonably constant. A significant advantage of the multi-year procurement technique over the BOA is that each requirement does not have to be justified (authority to negotiate and D&F) once the multi-year contract is signed. ASPR 1-322 sets forth the metes and bounds for utilization of the multi-year procurement approach.

The indefinite quantity contract is appropriate in those situations where it is difficult or impossible to determine in advance the precise quantity; i.e., student load and number of training courses required during a precise period of time, but where there is a certainty that a minimum quantity will be required. This type of contract requires the contractor to provide, during the contract period, specified services with deliveries scheduled by the placement of orders by designated activities. The contract provisions require the Government to order a specified minimum quantity and the contractor to deliver this minimum quantity within the contract period. Further, if ordered, the contractor is required to provide additional effort up to a maximum amount stated in the contract.

LCC (Life Cycle Costing) is a procurement technique of estimating costs on the basis of the total cost of ownership. The total cost of ownership is the total cost to the Government (as incurred by the contractor) during the life cycle of the utility, including R&D, operation, maintenance and investment costs. LCC contracts are evaluated on the variables of cost, maintainability and reliability; the latter two variables would not exist in a pure services contract. Compared to more conventional techniques, LCC solicitations are more costly to prospective contractors and more costly to the Government and the contractor to administer. The LCC technique is best suited to hardware procurements since it is mandatory that all cost elements be specifically identified to permit offerors to submit proposals on a compatible basis. LCC would be a possible procurement approach if this could be done in the area of training. There is, however, the problem of verifying and demonstrating the degree of training which is difficult to validate. LCC contracting is most beneficial and most likely to reduce costs where data or verification techniques make a number of elements available for costing. The problems associated with costing and verification of the degree of training are two of the more serious restrictions against the LCC approach for training. The LCC concept has many benefits regarding cost savings, however, and will not be rejected as a procurement approach for obtaining training services until all avenues are explored.

CONTRACTUAL CONSIDERATIONS. The previously discussed procurement techniques represent one of several procurement issues which impact upon the concept of commercial contract training. Other contractually related issues investigated during the study included:

1. Training Facilities
2. Contract Cost
3. Contract Flexibility
4. Contract Provisions
5. Training Specification
6. DIDs (Data Item Descriptions)

Either Government or contractor facilities may be used in the performance of a training services contract; however, procurement regulations discourage the use of Government facilities, particularly new facilities, when suitable alternatives will suffice. ASPR 13-301(c) states "New facilities shall not be provided by the Government where an economical, practical alternative exists." Existing Government facilities can be used and provided as Government Furnished Material if determined to be in the best interest of the Government. In this situation, the Government is responsible for assuring the adequacy of the facilities during the life of the contract. Any disruption of the facilities would probably be a justifiable delay claim against the Government. Depending on the circumstances, student transportation costs to a contractor's facilities could justify the use of Government furnished facilities. A basic study finding is that each training services procurement should be thoroughly analyzed as to whether contractor or Government facilities are most appropriate to the situation. The Government's intent should then be specified in the solicitation.

The ASPR analysis addressed the issue of costs from the contract viewpoint whereas Section VII addressed the issue from the economist's viewpoint. It is difficult to estimate a representative cost figure for training services as these costs vary widely dependent on the specific circumstances; i.e., facilities, number of students, and course length. An analysis of representative procurements indicates the labor rate to be between $4.00 and $8.00 an hour before application of overhead, G&A (General and Administrative) and profit. A more definitive rate can be established only when specific training requirements are known. Furthermore, when dealing with the issue of training services, NAVMATINST 4860.12A must be taken into consideration. This instruction sets forth Navy policy regarding work conducted in-house or out-of-house. It states that "Generally an in-house operation should not be approved unless costs of in-house performance will be at least 10% less than costs of obtaining the product or service from a commercial source." This instruction should be considered before the procurement of any training service.

Contractual flexibility is an important consideration in training service procurements. Training service contracts reviewed during this study did not contain the degree of specificity or flexibility considered necessary for an efficient training program. For example, modern training concepts such as self-paced instruction and training to proficiency are not compatible with the normal fixed delivery schedules of most contractual documents. Furthermore, contractual flexibility is a necessity in providing the capability to respond to "on-call" training to meet unscheduled training requirements and to accommodate the unscheduled delivery of students inherent in the self-paced instruction techniques.

To achieve the desired flexibility in a training services contract requires that certain basic contractual provisions be provided. As a minimum, a training services contract should have the following provisions:

1. Assurance that the administrative integrity of both parties is maintained.
2. Specifically defined areas of responsibility for both parties.
3. Assurance that the number of students receiving training at a given time is acceptable to both parties.
4. Definition of the specific obligations of the contractor relevant to faculty, student supervision and adherence to Navy training standards and policies.
5. Technique for program evaluation.
6. Procedures for efficient contract revision.
7. Specific beginning and terminal contract dates.
8. Certification procedures.
9. Definition of facility responsibilities.

10. Definition of training specification and delivery schedule.

The document which sets forth the nature and objectives of the training program is one of the most important documents in the contract. This may be either a work statement or a training specification. This document must specifically state the training services desired, while simultaneously remaining flexible enough to permit instructional freedom. A sample training specification and work statement will be developed during Phase II to be used as a guide in the procurement of training services. The specific circumstances under which these documents should be used and the content required to reflect the concept of training to objectives will also be developed during Phase II.

Existing training DIDs were reviewed during the study to determine their adequacy for training services procurements. The review included DID H-4001 through H-4011. Revisions to these DIDs would be required to accommodate modern training concepts; however, it may prove more efficient and cost effective to eliminate DIDs in training services contracts for the type of training under consideration. This will be considered in Phase II.

SUMMARY. The ASPR analysis indicates that the procurement of training services from commercial sources may be accomplished within the framework of existing procurement regulations. It appears that certain problems will have to be resolved; however, these are not considered major. Many of these problems will be resolved during the Phase II development of a training specification and work statement and the development of cost proposal evaluation techniques and administrative contractual procedures. Local implementing regulations are considered necessary to achieve a procurement function responsive to training requirements and capable of performing contractual functions.

SECTION VII

ECONOMIC ANALYSIS

This section of the report addresses the findings of the economic analysis of Navy and commercial training. The analysis includes commercial and Navy economic philosophies on training; application of the systems approach and training to objective concepts to training economics; training cost model characteristics, development, and applications; representative industry training costs and other related economic issues.

The findings of the economic analysis led to the decision to develop a training cost model to enable the determination of the true cost of Navy and commercial training. The rationale behind this decision, the development process involved, and the proposed utility of the model are discussed in this section. The training model is unique in that it may be used by any training activity (i.e., Navy, industry and educational institutions) to determine and compare true training costs.

BACKGROUND. As noted in Section II, industry has adopted the "human resources" point of view to training. They recognize the opportunity to profit from these resources and to achieve a capital gain on their investment in training. The Navy is not structured as a profit making activity; however, like industry, it must be concerned with the economics of training. The influence of economic theories in training management is pervasive, despite the tendency of many managers, Navy and civilian alike, to overlook and ignore the importance of the theory-practice relationship.

The findings of the economic analysis strongly support the need for a training cost model that will provide true training costs. The need for this model stems from one very basic question: What does it cost to train Navy personnel? There are other questions which must be considered before an attempt can be made to answer this question. For example:

1. Should all training (e.g., recruit training, specialized training and professional training) be considered?
2. Should on-the-job training or correspondence training be considered?
3. What costs should be considered?
4. Should unsuccessful training be included?
5. Is non-wartime operational duty considered training?

These and other similar questions require answers before a high confidence reply to the initial question can be provided. Questions such as these are generally responded to with other questions in order to evade a commitment. The secondary line of questioning is merely an attempt to bound the problem in order to provide a high confidence solution.

The investigative effort which has taken place during the data gathering phase of this study was one in which questions were bounded to the greatest degree possible, considering the time and resource constraints applied. Training objectives, type of training, training costs, and cost-benefit were discussed with industry representatives on numerous occasions. However, the industry information gathered regarding cost and cost-benefit did not at first appear to relate to Naval training. The reasons for this apparent lack of correlation between the public and private sector training programs were investigated in the specific area of training system cost analysis. The following conclusions were reached:

1. Only a small number of agencies within Government and industry have training accountability systems based on the achievement of training objectives.

2. Non-identifiable indirect charges mask the true cost of training in most cases.

3. In those cases where cost centers are established for training, the physical resource requirements are generally not directly related to training objectives.

4. Some budgetary and accountability systems in both industry and Government are very effective internally, but are not easily adaptable for comparative evaluations.

COST MODEL DEVELOPMENT. As a result of the above observations, it was concluded that a cost analysis model would be required which could be applied to the public or private sector with equal validity. It would be used to determine the true cost of training, to compare training system costs, and to provide a basic tool needed in the process of developing cost effective training. To be effectively applied, the cost analysis model required the following characteristics:

1. Representative of real-world
2. Broad application capability
3. Pedagogically adaptive
4. All-inclusive cost capturing categories
5. Non-ambiguous cost categories
6. Usable for budgetary and accountability purposes

7. Capable of providing cost-comparative information

8. Minimum of sophistication

The above constraints were studied and an initial cost model boilerplate was produced. The training system was considered to be any training activity which takes place for the purpose of modifying the skill and knowledge profile of trainees in accordance with system design goals. As such, the training system might be a military training command, a corporate training center, a technical training program, or a single individualized self-paced training station. The development of the cost model had to be preceded by a description of the system being considered.

When the systems approach to training is used as a basis for development, many different systems can be described which will produce an acceptable product. Consequently, it follows that objective-based training specifications should be provided for proposed contract training of Government personnel. This approach permits the development of unique approaches to training system design, and educational strategies would include the mix of training system variables based on cost and effectiveness. Length of course, student-to-instructor ratio, laboratory time and type of facilities are not relevant if the training objective is met.

Many costs must be considered before an attempt can be made to develop a generalized cost model. Direct costs, indirect costs, fixed costs, variable costs, sunk costs, opportunity costs, and many others are relevant to the development of a generalized cost model. Consequently, the initial development of a cost model should be preceded by a definition of terms. In this model, cost is considered to be the consumption of human, natural, or physical resources, and the passage of time. This is essentially the same as saying that cost is the wear, deterioration, or obsolescence of physical resources, the depletion of natural resources, the expenditure of labor, or the normal yield on capital investment. Budgetary and accountability systems have been used in industry which reflect all of these costs, and the only new approach being taken in the training field is in the application of objective-based cost analysis techniques. Government, however, is not profit motivated. Consequently, the major emphasis has been to account for expenditures to the satisfaction of the taxpayer. Recently, however, the taxpayer and the taxpayers' elected representatives have been asking the questions: What products or services did we receive for expenditures made? and, might not those resources be better applied in other areas? This line of questioning provides a forcing function, not only on the Navy, but on all taxpayer-supported agencies, to provide a cost-benefit analysis along with expenditure proposals. It was with this thought in mind that a generalized cost analysis method was developed. It can be applied not only to the Naval training community, but to any private or public training activity.

Hundreds of cost elements were identified during the study which were attributable to the training process. They ranged from the cost of fuel to heat the training facility to the cost of providing retirement benefits for the instructional personnel. Based upon this collection of cost elements, a number of broad cost categories were established which include all cost elements, and which are variable. As an example, increased expenditures for instructional material development might result in decreased instructional personnel and student expenditures. This might result in an overall cost reduction, but the reduction would not be apparent without a well-defined sequence of training operations based upon desired objectives and the related costs of each.

The cost model can be basically represented as:

$$C_{TTO} = T_{ACH} \times C_{TRH}$$

Where:

C_{TTO} = Cost of Training to Objective

T_{ACH} = Time Required to Achieve Objective (Hours)

C_{TRH} = Cost Per Trainee Hour

Using this basic representation, it becomes apparent that two approaches can be taken to reduce the cost of training. They are:

1. Reduce the time required to achieve the objective
2. Reduce the cost per trainee hour

Both approaches are being used in industry; however, the significant one is time reduction. This is generally accomplished by identifying need-to-know training objectives and developing effective instructional packages to meet these objectives. The training time compression which normally results can effect cost reductions which more than offset the expenditures made for the development effort. A cost benefit evaluation is normally conducted to determine which training programs offer the greatest cost reduction potential.

If the cost of training to objective is a function of training time and hourly cost, then it is possible to plot isocost curves for equal cost training as shown in Figure 2.

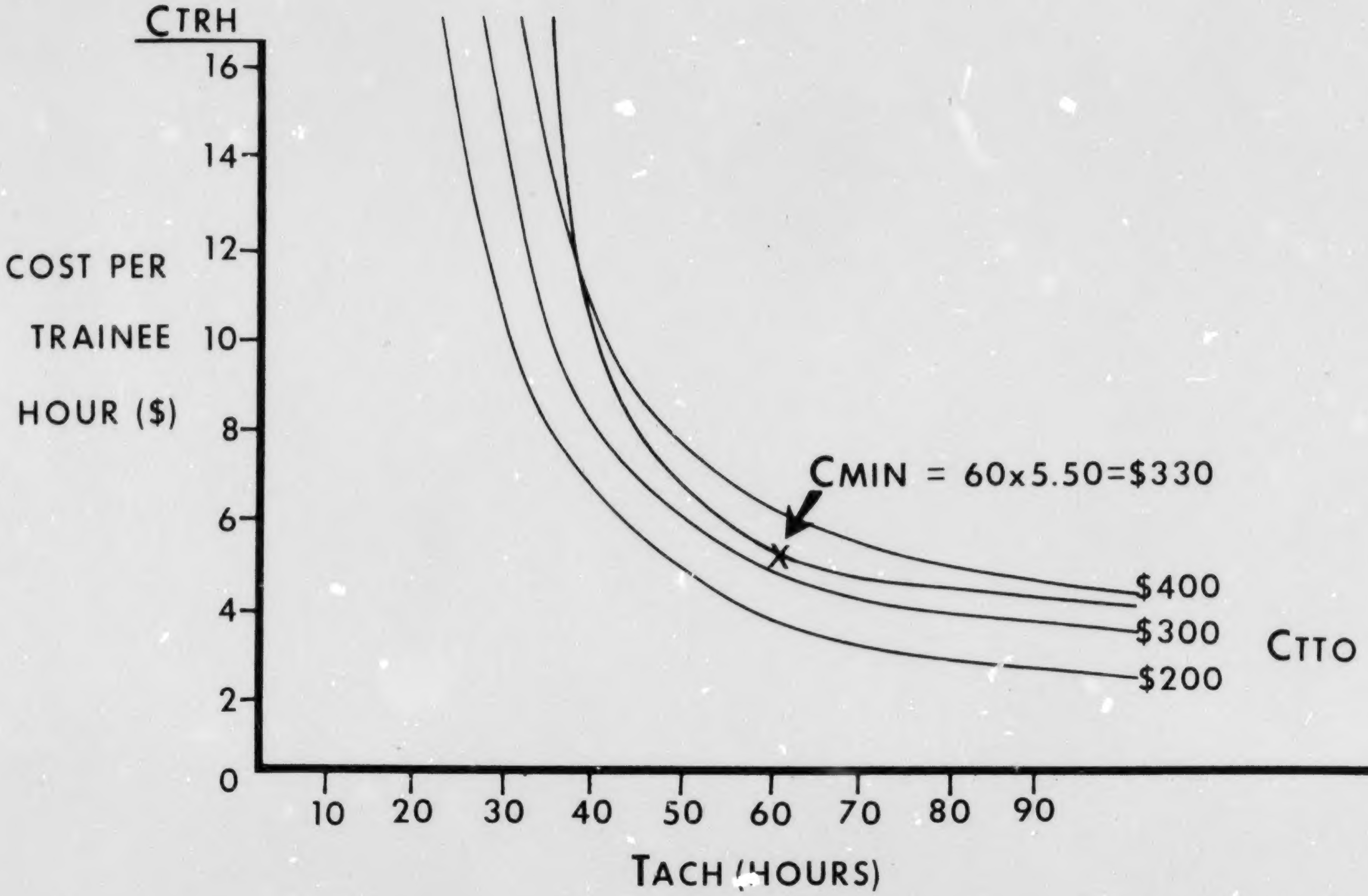


Figure 2. MINIMUM COST SOLUTION FOR TRAINING TO OBJECTIVE

A number of these curves can be plotted for the normal training cost range and an estimated cost function can then be overlayed for a given training program as a function of time to achieve the training objective. This will provide a graphical display of the minimum cost range. In this example, the minimum cost program would be 60 hours of training at $5.50 per trainee hour for a total cost of $330.00.

Any of a number of methods can be used for minimization of cost to achieve the objective. However, the results will be no better than the estimates of course duration and cost upon which the curves are based.

Achievement of the training objective represents the benefit gained, because of its qualitative nature, quantification beyond the pass-fail achievement measure is very difficult. This "go, no-go" approach is, however, sufficient to look at training system configuration mixes capable of meeting system goals and to determine the costs associated with these mixes. Although training benefit quantification is not currently feasible, research is continuing in this area and new tools are being developed which will provide for higher confidence value measurement of training in the future. Training cost analysis is not similarly constrained. Tools are available, but are not being applied as effectively as they should be.

The cost analysis guidelines and data sheets (Refer to Appendix B) used in this study were based on the previously discussed rationale. Proper application of the procedure outlined will provide a means for determining the cost of training per trainee hour, which is of major importance in any training system cost-benefit evaluation. The major categories established for this cost analysis procedure are:

1.	Facilities	Investment
2.	Equipment	
3.	Instructional Material Development	
4.	Personnel	Yearly Expenditures
5.	Supplies	
6.	Students	

As shown in Appendix B, each of these are subcategorized and, for cost evaluation purposes, the investment categories are converted to yearly costs by applying depreciation, yield rates, and operation and maintenance expenditures.

As previously stated, cost is considered to be the using up of resources and time, and, for the public sector, limitations placed on minimizing costs are often self-imposed. For example, the leasing of facilities, equipment, or instructional material over their useful lifetime allows for the use of high-dollar capital items without major perturbations in the funding cycle.

This approach is not generally possible within the Government. Industry is not constrained by this artificial barrier because funding can normally be obtained for a profitable venture regardless of expenditure time phasing. This industry flexibility, combined with the income statement yardstick, provides the essential elements for producing cost-effective training programs. A similar flexibility and yardstick within government would be very valuable.

A summary of industry training costs and cost ratios is shown in Figures 3 and 4. Although the absolute value of cost per hour of training is an important element of the cost analysis, it appears that

TYPE OF TRAINING	SALES & MGT	AIRLINE GROUND SCHOOL	UTILITY COMPANY TECH	VOCAT TRAINING	SEMI-CONDUCTOR THEORY
STUDENT HOURS PER YEAR	71,500	170,000	25,600	30,000	28,800
STUDENT TO INSTRUCTOR RATIO	20:1	6:1	10:1	15:1	16:1
YEARLY COSTS					
FACILITIES	18,800	82,400	10,000	5,300	2,500
EQUIPMENT	8,700	202,000	9,400	1,900	2,000
INSTRUCTIONAL MATERIAL	79,500	66,500	17,600	4,000	48,000
PERSONNEL	63,700	677,000	90,200	32,000	23,000
SUPPLIES	41,600	25,000	41,400	3,600	25,000
STUDENTS	1,250,500	2,700,000	243,200	—	288,000
TOTAL YR COST EXCL STUDENT COST	212,400	1,053,000	168,600	46,800	100,500
TOTAL YR COST INCL STUDENT COST	1,462,900	3,752,900	411,800	—	388,500
COST PER STUDENT HOUR EXCL STUDENT COST	2.97	6.20	6.59	1.56	3.49
STUDENT COST PER STUDENT HOUR	17.49	15.88	9.50	—	10.00
COST PER STUDENT HOUR INCL STUDENT COST	20.46	22.08	16.09	1.56	13.49

Figure 3. TYPICAL INDUSTRY TRAINING COSTS

	SALES & MGT	AIRLINE GROUND SCHOOL	UTILITY COMPANY TECH	VOCAT TRAINING	SEMI-CONDUCT THEORY	AVERAGE
EXCLUDING STUDENT COST						
% TOTAL YEARLY COSTS:						
FACILITIES	8.9	7.8	5.9	11.3	2.5	7.3
EQUIPMENT	4.1	19.2	5.6	4.1	2.0	7.0
INSTR MATERIAL DEV	37.4	6.3	10.4	8.5	47.8	22.1
PERSONNEL	30.0	64.3	53.5	68.4	22.9	47.8
SUPPLIES	19.6	2.4	24.6	7.7	24.9	15.8
INCLUDING STUDENT COST						
% TOTAL YEARLY COSTS:						
FACILITIES	1.3	2.2	2.4	11.3	0.6	1.6
EQUIPMENT	0.6	5.4	2.3	4.1	0.5	2.2
INSTR MATERIAL DEV	5.4	1.8	4.3	8.5	12.4	6.0
PERSONNEL	4.4	18.0	21.9	68.4	5.9	12.6
SUPPLIES	2.8	0.7	10.1	7.7	6.4	5.0
STUDENTS	85.5	71.9	59.1	—	74.1	72.6
APPROXIMATE TRAINING TIME COMPRESSION (%)	35	35	30	30	50	36

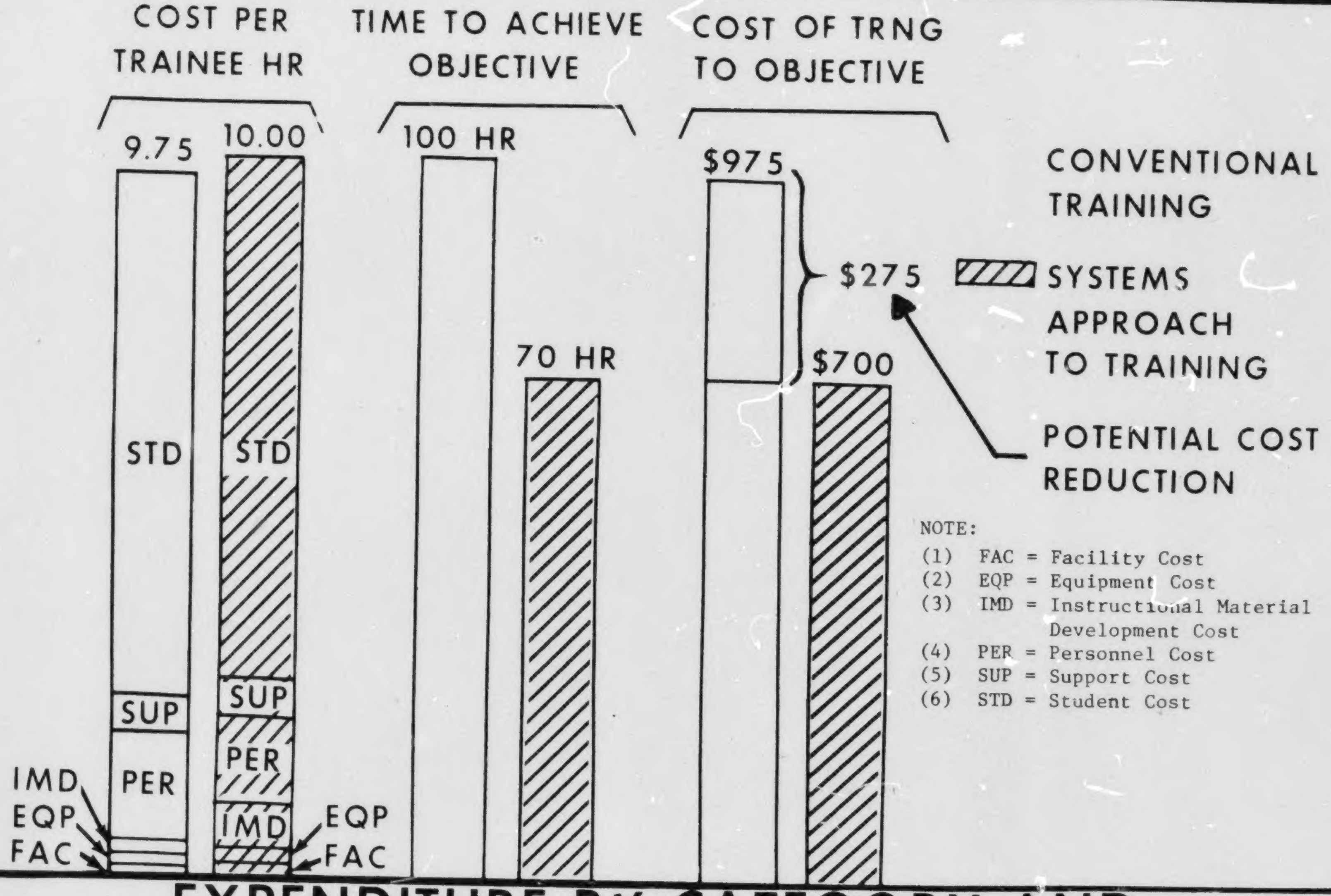
Figure 4. EXPENDITURE CATEGORY RATIO BASED ON TYPICAL INDUSTRY TRAINING COST

the most useful information which can be obtained from this summary is the percentage of total expenditure by category, and the time compression achieved.

Based on this information, a typical example of cost reduction is shown in Figure 5. This is not representative of any particular company but reflects average costs, time compression results and cost reductions experienced by many of the companies visited. If similar results could be achieved in the Naval training community, many millions of dollars in costs could be avoided.

Many of the companies which have implemented the systems approach to training have experienced increased productivity in operational areas. This is a bonus gained by removing mind-cluttering information, and it appears that this benefit would also accrue to the Navy if similar systems were developed.

SUMMARY. Much of the information gathered is considered scientifically soft at this time because it is based, to a significant degree, on opinion, approximation and judgment. However, a high level of confidence is considered appropriate for this information because of the professional status of the industry personnel providing the data. Significant effort is currently being expended by many major corporations to validate their preliminary findings which are for the most part similar to those presented in this report. This validation process is also taking place to a limited degree within the Navy and models are being developed for those segments of training which appear to offer maximum benefit within a reasonable time frame.



NOTE:
(1) FAC = Facility Cost
(2) EQP = Equipment Cost
(3) IMD = Instructional Material Development Cost
(4) PER = Personnel Cost
(5) SUP = Support Cost
(6) STD = Student Cost

Figure 5. EXPENDITURE BY CATEGORY AND POTENTIAL COST REDUCTION

Additional effort is also being directed, within TAEG, toward developing optimal approaches to training system design based on cost and benefit. Preliminary results indicate that seemingly obvious cost reduction areas do not necessarily provide the best returns. As an example, it appears that facilities and training equipment cost reduction programs would prove effective. However, for the general case, the information gathered indicates that only 2% to 8% of a training budget is expended on these items. Within the Navy, the military personnel budget appears to be the real target for cost reduction and this reduction could be achieved through the application of advanced instructional technology. The resulting time compression cost reductions would more than offset expenditures made if industry findings are valid and transferrable to the Naval training community. Significant strides have been made by industry in developing the systems approach to training, and based upon the initial results of this study it is apparent that continued Navy-industry interface in this area will prove beneficial.

SECTION VIII

CONCLUSIONS AND RECOMMENDATIONS

A summary of the major conclusions and recommendations of the Phase I staff study is presented below. A brief discussion accompanies each item. Many of the recommendations and conclusions pertain to management and areas requiring further study regarding the concept of utilizing commercial sources for Navy training. Other recommendations and conclusions address issues which indicate the need for major policy changes. All of the recommendations have the common goal of, and potential for effecting beneficial changes to Navy training through increased training effectiveness and efficiency with corresponding cost savings.

CONCLUSIONS

1. Industry and non-federal post-secondary training institutions have the capability and facilities to provide effective training to Navy enlisted personnel in basic technical and vocational skills. Contract training with these sources in selected skills provides an opportunity to greatly expand Navy training capability by providing technical training programs to supplement present Navy training, to eliminate costly duplication of existing civilian facilities, and to provide specialized training not offered by Navy schools.

2. The systems approach to training is widely used by industry and non-federal post-secondary training institutions in the development of training programs.

3. Industry recognizes the value of, and need for, cost effective in-house training and is applying innovative educational techniques to meet their training needs.

4. Public and private, non-federal post-secondary training institutions develop training programs to meet the specific needs of the community. Navy utilization of such institutions should be carefully considered since a disproportionate number of military students could adversely affect the civilian-military relationship.

5. Civilians trained in selected skills by non-federal post-secondary institutions can meet Navy "A" school level graduation requirements. The Phase I, Electronic Technician Direct Procurement Petty Officer (DPPO) Program, conducted by the Navy Personnel Research and Development Center (NPRDC TR 42-20 of March 1974) supports this conclusion.

6. Many public area vocational/technical schools and junior community colleges have established effective feedback systems which enable the user of their product (the trained student) to report changes in occupational training institutions to revise curricula as necessary to keep pace with technological advances.

7. The concept of commercial contract training does not require changes to the ASPR. Contractual techniques and administrative procedures can be structured to efficiently accommodate the requirements inherent in procuring Navy skill training from commercial sources.

8. In general, both industry and non-federal post-secondary vocational/technical training institutions are receptive to the concept of conducting training for Navy personnel at the "A" school level and will tailor training programs to meet the specific needs and standards of the Navy. Due to variations in training capabilities and standards, the selection of commercial contract training sources should be on a case-by-case basis.

9. The application of cost effectiveness and cost benefit analysis throughout the training program development cycle is an accepted practice in industry. Substantial cost savings can be achieved through utilization and refinement of such techniques in the Navy training system.

10. Only those commercial sources physically located within reasonable commuting distance of the students' assigned base should be considered for training military personnel at the "A" school or apprentice level. This philosophy will (a) optimize economy of housing, messing, and associated administrative support and (b) retain the young impressionable recruit in a military environment.

11. Government and industry accounting systems are not structured to enable the determination of the true cost of training. A standard accounting system specifically designed to represent the true cost of training is required.

12. Industry has significantly increased the flexibility and capability of training facilities through the incorporation of advanced design concepts. Such concepts have proven effective in reducing maintenance and modification costs.

13. There is a trend within industry to centralize training management control within the corporate structure. Many of the management practices and philosophies of industry have beneficial application to the Navy.

14. The majority of industrial activities develop career professional educators and instructors, advancing qualified personnel on merit to management level positions.

15. Personalized training programs in being and under development in the civilian sector have application to Navy career development and planning.

16. Those industrial activities that have long-range training plans and strategies have the most effective training programs.

17. Standardization of training facility design, instructional equipment, instructional techniques, and training curricula is a standard practice within industry.

18. Instructors in industry are required to attend professional instructor training courses prior to classroom instruction. Such courses include instruction techniques, instructional equipment and curricula development.

19. Commercial training sources have the capability and facilities to provide training to Naval Reserve personnel. Such sources should be considered in mobilization planning.

20. Commercial training sources require evaluation on an individual and competitive basis due to the lack of standardized criteria for goal achievement in the area of technical skill training.

21. Industry is experimenting with, and using, many advanced education and training concepts to improve the effectiveness and efficiency of training. The large number of new training equipment available necessitates critical examination of training requirements prior to purchase of such equipment.

RECOMMENDATIONS

A. Management - The following recommendations are based on observations of the various management philosophies and practices within the industrial activities and the vocational/technical institutions surveyed during this study. The following is recommended:

1. The CNET should continue to support efforts directed toward centralized training management. This philosophy is accepted in industry as the most efficient means of achieving positive program control, training program continuity, training effectiveness, training efficiency, training standardization, training cost reductions and effective program planning.

2. A full-time staff activity responsible for long-range planning strategy should be established by CNET. The functions of this staff should include as a minimum:

a. The impact of foreign national policy on Navy training.

b. The impact of DoD policy on Navy training.

c. The impact of new weapon systems on Navy training.

d. The application of long-range R&D efforts in education and training technology to Navy training.

3. Continued effort should be devoted to the standardization of education and training technology. This should include all facets of education and training such as instructional methodology, instructional media, program development, facilities, certification, and instructor qualifications.

4. The CNET should continue efforts to consolidate education and training facilities. Such consolidation effort should include consideration of the current efforts being devoted to the concept of interservice training.

5. The efforts being devoted by the CNET to improve communication channels through exchange of training and education data between subordinate commands, other services, and civilian activities should be continued.

6. The CNET should initiate a program to simplify the RMS (Resource Management System) to effect maximum utilization of personnel and equipment in its training programs.

7. Continued effort should be directed toward the centralized control of training and education research and development programs. Results of these programs should be reported periodically and given wide distribution throughout the Navy through such means as published articles, reports and conferences.

8. The CNET should adopt standardized task analyses methods. Administrative procedures and appropriate guidelines should be established to insure that task analysis is applied during the acquisition of all new weapon systems and platforms and during all training development programs.

9. The CNET should continue efforts, within the areas examined in this study, toward interservice training and the use of appropriate DoD agency schools to satisfy Navy basic skill training needs. Progress in this area will result in training cost reductions for the Navy and increased training management efficiency.

10. Emphasis should continue to be placed on the development of an effective Navy-wide feedback system for education and training. An effective feedback system, accepted by all Navy commands, will greatly increase the efficiency and effectiveness of Navy training.

11. A career field relating to education and training should be established for Naval officers, enlisted, and civilian personnel. This career field is required to elevate the professional status of Navy education and training personnel and to maintain the program continuity of all training and education activities.

12. The current effort being devoted to improving instructor training techniques and methodology should be continued.[6] The concept of classroom managers should be included in instructor training curriculum. Consideration should be given to mandatory periodic refresher instructor training to keep Navy instructors abreast of the latest changes in training technology and instructional techniques.

13. The CNET should continue to develop and refine self-paced individual and team instruction techniques. Significant cost reductions can be achieved through appropriate utilization of these techniques.

14. Continued effort should be directed toward the standardization of training and education terminology. This effort should be considered by personnel charged with the responsibility for interservice training and education.

15. Procedures should be established to realign techniques for inspection and evaluation of the Navy training program. Such procedures should be specific in nature to permit meaningful evaluation of the effectiveness and efficiency of training programs.

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[6] Under Work Assignment 1104 the TAEG is conducting a staff study concerned with developing means for producing more effective instructor personnel to conduct and manage Navy training. This task is described in TAEG "Proposed Plan of Action and Milestones for Task Instructor Training," dated 29 June 1973.

16. A standard technique for economic analysis should be established for the education and training community. This technique should be based on the basic economic analysis concepts set forth in Section VII of this report.

17. The CNET should continue efforts for the certification and accreditation of Navy skill and technical training courses. These efforts should closely parallel the "Community Colleges of the Air Force" concept.

18. Continued effort and growth should be encouraged for the standardization of training aids and devices. The effort being devoted to consolidation and standardization within the cognizance of CNETS closely parallels the consolidation and standardization philosophy of many industrial organizations.

19. The CNET should consider the utilization and application of the concepts set forth in appropriate Navy training situations:

a. Cognitive style mapping

b. Managed on-board training vs. on-board training (e.g., formalized control vs. non-formalized control)

c. Shipboard satellite training

d. CAI remedial education

e. Civilian recognized Navy training certificates

f. Motivation as a major education and training consideration (e.g., this includes job induced (extrinsic) as well as such intrinsic motivation as attitudes and incentive to perform)

g. Modular structured courses (increased emphasis)

20. The CNET should consider non-federal post-secondary training institutions as training sources in mobilization planning.

21. Non-federal and post-secondary training institutions should be considered as sources for appropriate Naval Reserve training. These institutions are currently being used for certain types of Marine Corps Reserve training.

22. The CNET should establish programs to improve the classification procedures for new personnel.

B. Commercial Contract Training - The Phase II portion of this study will be devoted to the three Navy skills selected by the CNET. These skills are:

1. Lithographer rate training at the "A" school level
2. Yeoman rate training at the "C" school level
3. Machinery Repairman rate training at the "A" school level

Based on the assignment of the above ratings for in-depth analysis, and the results of the Phase I study, the following is recommended:

1. The Phase II effort should include an analysis of selected Marine Corps skills as requested by the Commandant of the Marine Corps.

2. Industry sources should be surveyed relative to their interest in providing training for specific Navy and Marine Corps skills.

3. An in-depth feasibility analysis should be made of one or more of the skills selected by industry for training. This analysis should include consideration of instructional technology, cost benefits, and contractual procedures.

4. The non-federal post-secondary training institutions considered for Navy and Marine Corps contract training should be limited to those located near large Navy and Marine Corps bases. These institutions

should be surveyed on the basis of interest in providing basic training in selected Navy and Marine Corps skills.

5. The revised MIL-STD-1379A, Contract Training Program with associated DIDs and DD Form 1423 should not be used in commercial training contracts. Such utilization is considered economically impractical.

6. A modified MIL-STD-1379A specification should be developed which is specifically tailored to the requirements of skill training. Furthermore, consideration should be given to the utilization of the Indefinite Delivery Type Contract as defined by paragraph 3-409 of the ASPR. The agreement between the government and the contractor should be executed by Standard Form 1155 to purchase individual courses.

7. Terminal objectives should be developed as part of the training course specification.

8. Economic analysis techniques should be developed which are applicable to Navy and Marine Corps in-house training programs and for proposed commercial contract training. This analysis should address cost benefit and cost effectiveness analysis in accordance with GAO (General Accounting Office) and OMB (Office of Manpower and Budget) practices.

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APPENDIX A

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APPENDIX B

CNT PROJECT C-3

INTER-SERVICE/COMMERCIAL CONTRACT TRAINING

INDUSTRY SURVEY GUIDELINES

1. Name of Organization:______________________________

2. Address of Organization:______________________________

3. Point of Contact of Organization:______________________________
(Name, Title, Phone, etc.)

4. Total No. of Employees in Organization:______________________________

5. Primary Product of Organization:______________________________
(Product Line, manufacturing, research,
____
services, etc.)

6. Overall Description of Organization Structure:______________________________
(Organization charts,
____
description of responsibilities, etc.)

7. Description of Training/Education Portion of Organization:______________________________
(Organization
____
chart, controls, responsibilities, number personnel, etc.)

8. Organization Training Centers:______________________________
(Address, points of contact, capabilities,
____
etc.)

9. Training Philosophy Description:______________________________
(Including internal training, external
____
training, training policy determination, training programs, etc.)
____

10. Training/Education Financial Description:______________________________
(Total training yearly budget,
____
budget breakdown by type training, etc.)
____

11. Education R&D Effort Description:______________________________
(Number employees involved, yearly
____
financial investment, hardware in development, education techniques and
____
approaches, etc.)

12. Training Staff Description: ____________________
(Including number of administration personnel, instructors, managers, education specialists and support personnel)

13. Description of Training Capabilities of the Organization: ____________________
(including yearly total student training hours; breakdown of total training hours by type training; total number students processed per year; type training offered such as management, craft professional, course outlines; maximum student load capacity, facilities size and number)

14. Description of Instructor Personnel: ____________________
(Including selection criteria, number of instructors, responsibilities, training, average platform time, source, motivation factors, etc.)

15. Training Controls: ____________________
(Cost controls, media update procedures, curriculum update procedures)

16. Student Population: ____________________
(Type student, selection criteria, etc.)

17. Program Development Description: ____________________
(Course development, media selection, content, strategies, etc.)

18. Program Evaluation Criteria: ____________________
(Validity, effectiveness, costs, attitudes)

19. Relation of Educational Objectives to Job Performance: ____________________

20. Relation of Job Training and Performance to Hiring: ____________________

21. Relation of Job Training and Performance to Equipment Design:____________

____

22. Selection of Instructional Media Techniques and Analysis:____________

____

23. Course Pre-test and Post-test:______________________________
(Philosophy and techniques)

____

24. Training feedback:______________________________________
(Techniques, controls, utilization, measurement, etc.)

____

25. Instructional Techniques:__________________________________
(Lecture, CAI, CMI, PI, etc.)

____

26. Training Standardization:__________________________________
(Techniques, application, areas, etc.

____

27. Classroom Aids:____
(Response systems, computer terminals, panels, carrels,

____
simulation, etc.)

28. Field Training:____
(Administration, instructional techniques, type training,

____
costs, number students, etc.)

29. OJT Training:____
(Administration, type training, percentage of total

____
training, etc.)

30. Off The Job Training Programs:_____________________________
(Home study programs, college, company

____
financial aid, type programs, etc.)

31. Govt. Contract Training Currently Provided:________________
(Name and address of agency,

____
type training provided, student output, procurement vehicle, contract

____
number and type, etc.)

32. Future Training Projections:______________________________
(CAI, CMI, CCTV, Trends, techniques,
____
approaches, company philosophy and predictions)

33. Organization Interest in Providing Navy Training:__________________
(Type training,
____
conditions, etc.)

TAEG REPORT NO. 13-1

TRAINING SYSTEM COST ANALYSIS
DATA FORMS AND GUIDELINES

TRAINING SYSTEM COST ANALYSIS

ORGANIZATION: ______________________________

ADDRESS: ______________________________

____

POINT OF CONTACT:

NAME: ______________________________

TITLE: ______________________________

PHONE: ______________________________

TYPE TRAINING: ______________________________

____

COURSE TITLE: ______________________________

____

COURSE LENGTH: ______________________________

STUDENTS/COURSE ______________________________

INSTRUCTION TECHNIQUE ______________________________

____

TAEG REPORT NO. 13-1

TRAINING SYSTEM COST ANALYSIS

For purposes of developing a training system cost analysis approach, the following definition will apply:

> A training system is considered to be an integrated relationship of hardware, software, and human subsystems configured to establish functional continuity from the point trainees are accepted for training to the point the stated training objectives are achieved.

This generalized definition is broad yet complete in that it categorizes the natural, physical, and human resources required to achieve a stated training objective. The costing approach developed and recommended for use can be applied to a course of instruction, an educational institution, a training division of a large corporation, or a governmental training agency. Cost categories have been provided which account for all training system costs in order to eliminate or reduce the requirement for overhead charges. This approach allows for high confidence results when making alternative system cost comparisons. For those cases which require multi-category overhead application, the charge should be prorated and included as part of the direct charge for the categories affected.

This costing approach will provide the cost information required for life cycle costing and will be used with the training system Economic Analysis model currently being developed.

CATEGORY	DESCRIPTIVE DATA	EX. RES.	NEW EXP.	INVESTMENT	YEARLY
FACILITIES	SQ. FT. $ PER SQ. FT.				
* ADMINISTRATIVE * INSTRUCTIONAL * SUPPORT * OTHER					
TOTAL					A
EQUIPMENT					
* OFFICE * CLASSROOM * LABORATORY * INSTRUCTIONAL AIDS * OTHER					
TOTAL					B
INSTRUCTIONAL MATERIAL	TYPE				
* AUDIO VISUAL * TEXT * SOFTWARE: - AUTOMATION - SIMULATION - GAMING * OTHER					
TOTAL					C

CATEGORY	DESCRIPTIVE DATA	EX. RES.	NEW EXP	YEARLY
PERSONNEL	NUMBER TOTAL YEARLY HOURS			
* ADMINISTRATIVE * INSTRUCTIONAL * INSTRUCTIONAL SUPPT. * OTHER				
TOTAL				D
SUPPLIES				
* OFFICE * INSTRUCTOR * STUDENT * OTHER				
TOTAL				E
STUDENTS	NUMBER TOTAL STUDENT HRS.			
* WAGES * TRAVEL * SUBSISTENCE * OTHER				
TOTAL				F

COST PER STUDENT HR. = $\frac{A + B + C + D + E + F}{\text{TOTAL STUDENT HRS.}} = \frac{\$}{\text{ST. HR.}}$

COST ANALYSIS GUIDELINES

GENERAL

Although many approaches can be taken to cost analysis of training systems, it is apparent that a standardized approach must be followed if comparative analysis is contemplated. For this reason, the following guidelines and categories have been established. Some general principles should be applied and take precedence in exception areas. They are:

1. Include all costs, regardless of source of funding.

2. Prorate overhead charges and assign to categories.

3. Personnel, equipment, and supply costs associated with maintenance and operation should not be included in personnel, equipment and supplies category.

4. Include R&D and investment under Investment.

5. Do not use investment as a cost of training. It is only used in this analysis as a basis for determining depreciation which will be included in yearly training cost.

COST ANALYSIS GUIDELINES

FACILITIES

1. Separate into appropriate categories.
2. Include land cost in investment, but not in yearly depreciation.
3. Provide floor space and floor space cost information if available.
4. Investment costs should include:
    - Planning, Research and Development
    - Investment, including land, structures, buildings, facilities equipment, and all other costs associated with investment.
5. Yearly costs should include:
    - Depreciation (consumption of resources)
    - Operation (facilities operation only)
    - Maintenance
    - Normal yield on outstanding investment

6. For leased facilities, lease cost should be used in place of yearly cost if all yearly costs are included.

TAEG REPORT NO. 13-1

COST ANALYSIS GUIDELINES

EQUIPMENT

1. Separate into appropriate categories

2. Investment costs should include:

   - Planning, Research and Development
   - Investment, including all costs associated with investment

3. Yearly costs should include:

   - Depreciation (consumption of resource)
   - Operation (equipment operation only)
   - Maintenance
   - Normal yield on outstanding investment

4. For leased equipment, lease cost should be used in place of yearly cost if all yearly costs are included.

COST ANALYSIS GUIDELINES

INSTRUCTIONAL MATERIAL

1. Include associated testing material.

2. Group in appropriate categories.

3. Texts include programmed instruction texts.

4. Software includes programs and documentation used with equipment which has been included under equipment category when it is part of an instructional package.

5. Identify type of instructional material within category.

6. Investment cost should include all planning, research, development and production cost of the master instructional material package.

7. Yearly costs should include update costs, amortization of investment, and normal yield on outstanding investment.

COST ANALYSIS GUIDELINES

PERSONNEL

1. Yearly costs include:
   - a. Salary
   - b. Benefits
   - c. Recruiting cost
   - d. Training
   - e. Travel and/or relocation
   - f. Subsistence
   - g. Other associated costs
2. Include number of personnel in each category.
3. Estimate total yearly hours worked in each category.
4. If one person works in more than one category, divide time accordingly.

COST ANALYSIS GUIDELINES

SUPPLIES

1. Include all yearly expenditures within each supply category.

2. Include student supplies paid for by student, but note student payment if applicable.

3. Student supplies include all materials, including instructional material, if used only once. For cases in which instructional material is used a number of times, divide cost by number of times used.

COST ANALYSIS GUIDELINES

STUDENTS

1. Consider yearly cost of students only if paid during training.

2. Include all wages and benefits for the duration of training plus travel and subsistence associated with training.

3. When student costs are considered, calculate cost of training with and without this cost factor to assess significance of this cost.

4. Provide information on number of students and total student hours per year.

COST ANALYSIS GUIDELINES

CALCULATION OF COST PER STUDENT HOUR

$$\text{COST PER STUDENT HR} = \frac{A + B + C + D + E + F}{\text{TOTAL STUDENT HOURS}} = \frac{\$\quad}{\text{ST. HOUR}}$$

A = Yearly facilities cost

B = Yearly equipment cost

C = Yearly instructional material cost

D = Yearly personnel cost

E = Yearly supplies cost

F = Yearly student cost (if applicable)

CCT QUESTIONNAIRE: INSTITUTIONS WITH DORMITORY FACILITIES

HOUSING:

Cost: ______________

Includes: Dormitory Room ______
3 meals per day, 7 days per week ______
Laundry, Dry cleaning ______
Student Clinic Services. ______

Capacity: Male: __________
Female __________

Dormitory Layout: (Sketch) Condition ______________________________

____

Stu. per Room ________ Bay: __________ Bldg. ______________

Furnished with:

Head Facilities: (per building)

Male: No. ______ Toilets _____ Urinals _____ Basins _____ Baths ____ Shwr _____

Female: No. ______ Toilets _____ Basins ______ Baths _____ Shwr ______

General Condition: ______________________________

____

Telephone(s) ____________ Per Bldg. ____________

Study Facilities ______________________________

____

Messing Availability to Housing: ______________________________

____

Building Security: ______________________________

Copy of Dorm. Rules ______________

Parking Facilities ______________ Fees? ____________________

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MESSING FACILITIES:

Capacity: ____________

Dining Hall Condition: ______________________________

____

Hrs. of Operation:

BFST: ____________________

Lunch ____________________

Dinner ____________________

Other ____________________

Quality of Food ________________

Dietitian Used? ________________

Kitchen: ____________________ Condition ________________

____

MILITARY ADMINISTRATION:

Office Space: OIC ________ NCOIC ________ Clerk ________ Supply ________

Supply/Storage Room: ____________ Location(s): ________________

Civilian Housing: ______________________________

____

Nearest Military Admin. Support: (Orders, Travel, Finance) ____________

____

Nearest Airport(s): ______________________________

Local Transportation ______________________________

____

SCHOOL:

Photographs & Sketches ____________

Course Outlines, etc. ____________

Integration Aspects ______________________________

____

Recreation, Activities

Distance From Town Center

Security and Discipline

Student Attitudes

Government Contracts or Agreements:

COMMUNITY:

Transportation:

Chamber of Commerce:

Churches:

Hotels, Motels:

Housing:

Recreation:

Local Attitudes:

Medical Facilities:

Population:

RECRUITING OFFICE (Post Office?)

CONTACT(S):

CCT QUESTIONNAIRE

INSTITUTION:

LOCATION (1) DIST:

LOCATION (2) DIST:

LOCATION (3) DIST:

LOCATION (4) DIST:

ACCREDITED BY (1)

(2)

ENROLLMENT	FULL TIME	PART TIME	TOTAL
TOTAL	________	________	______
DAY	________	________	______
EVENING	________	________	______

SIZE OF CAMPUS ________ ACRES

NO. BUILDINGS ________

CLASSROOM SPACE ________ FEET ______ ROOMS

LABORATORY/WORKSHOP SPACE ________ FEET ________ ROOMS

WHEN CONSTRUCTED: 19___ - 19___

FUNCTIONAL DESIGN: GOOD_____ FAIR_____ POOR_____

TUITION: ________PER ______________.

AVG. CLASSROOM LOAD________ STUDENTS

INSTRUCTOR/STUDENT RATIO: ___:___

COURSE DEVELOPER(S): ____

APPROACH: CONVENTIONAL___

SYSTEMS___

REMARKS: ____

____

____

INDUSTRY NEED CHECK? _____

NEED OF STUDENTS CHECK? _____

FORECAST NEED OF COMMUNITY EVIDENT? _____

ADEQUATE SOURCE OF QUALIFIED CANDIDATES? _____

LEARNING RESOURCE CENTER? _____

SIZE:

ITV _____ SOUND/SLIDES _____ 8MM _____

MICROFICHE _____ 16MM _____ P.I. _____

CARRELS: NO. ___ EQUIPPED WITH:

DRY ____ SOUND/SLIDE ____ FILM ____ CRT ____ RESPONSE ____

DISPLAY ____ P.I. ____ OTHER: ______________________________

USED FOR (COURSES): ______________________________

____

SPECIAL FACILITIES FOR TRAINING:

AUTO SHOP: ______________________________

ELECTRICAL SHOP: ______________________________

FOOD PREPARATION: ______________________________

DRAFTING: ______________________________

SMALL ENGINE (MAINT. & REPAIR): ______________________________

HEAVY EQUIPMENT OPERATION: ______________________________

HEAVY EQUIPMENT REPAIR: ______________________________

PHOTOGRAPHY LAB: ______________________________

SURVEYING: ______________________________

MATERIALS TESTING (CONSTR.) ______________________________

MACHINE SHOP: LATHE(S) ___ DRILL PRESS ___

SHAPER(S) ___ BENCH GRINDER(S) ___ MILLING MACH. ___

BORING MILL(S) ____ POWER HACKSAW ___

METAL ENGRAVING PANTOGRAPH ___ OTHER ______________________________

PRINT SHOP: OFFSET PRESS ___ PLATEMAKER (COPIER) ___
PLATEMAKER (BURNER) ___ STAPLING MACH. ___
DRILL (SINGLE SPINDLE) ___ COLLATOR: MAN. ___ AUTO ___
PHOTO LAB ___ LETTERPRESS ___ VARITYPER ___
HEADLINER ___ LIGHT TABLE ___ XEROX COPIER ___
METAL WORKING: SHEET METAL ___ GAS CUTTING/WELDING ___
ARC WELDING ___ RIGGING ___ METAL WORKING ___ STEEL ERECTION ___
DIESEL ENGINES (OPERATION & MAINT.) CATERPILLAR ___ INTERNATIONAL ___
CUMMINS ___ LD 465-1 MULTIFUEL ___ OTHER ______________________________
COMMUNICATIONS (MAINT. & REPAIR) SYNCHRO UNITS ___
ALARM, WARNING, CALL BELL ___ INTERCOM SYS ___
TELEPHONE ___ ANNOUNCING ___ GYROCOMPASS ___ SELSYN INSTRUMENTS ___
AIR CONDITIONING, HEATING, REFRIGERATION: ___
PROPULSION ENGINES: STEAM: 600 psi ___ 1200 psi ___
OTHER ______________________________
AUXILIARY ENGINES: BOILERS ___ DISTILLING ___
FOUNDRY SHOP: MOLDER ___ PATTERN MAKER ___ WOOD ___ METAL ___ PLASTER ___
FOUNDRY FACINGS ___
CASTING: NON-FERROUS ___ FERROUS ___ ALLOY ___
CUPOLA FURNACE ___ CORE BAKING OVEN ___ METALLURGY ___ THERMITE CASTING ___
ELECTRICAL CONSTRUCTION: (INSTALLATION/REPAIR)
HIGH VOLTAGE ___ LOW VOLTAGE ___ UNDERGROUND ___ GENERATORS ___
POWERPLANT CONTROL ___ CONDUIT INSTALL/REPAIR ___ LINEMAN ___
CONSTRUCTION: WOODWORKING/MILLWORK ___
LIGHT FRAME STRUCTURE ___ ROOFING ___ PAINTING ___ GLAZING ___ MASONRY ___
CONCRETE ___ PLUMBING ___

APPENDIX C

SUMMARY OF INDUSTRY TRAINING ACTIVITIES

SOURCE OF TRAINING	CATEGORIES OF INSTRUCTION	FACILITIES	PERSONNEL RESOURCES	TRAINING SYSTEM DESIGN	TRAINING EQUIPMENT	QUALIFICATIONS AND EXPERIENCE	COMMENTS
1032.2	Aircraft pilot maintenance clerical management Flight Attendant	Extensive training center, pilot, FT, several locations for maintenance training	Full staff of highly qualified specialists	Individualized self-paced Systems approach course compression "Hands On" emphasis Programmed Instruction Task Analysis	Flight Simulators full range AV equipment learning carrels	Many years successful training with regulatory agency supervision approved by FAA	Significant reduction in air training by use of simulators. Contract training: Self-paced Individualized instruction
1033.3	Telephone installation, maintenance and repair mgmt and sales basic electricity	100 major training centers - over 1400 classrooms with Labs adjacent	Approx 1700 instructors chosen for technical skills and mgmt ability	Systems Approach "Hands On", "need to know" policy. Cost effectiveness self paced inst.	Wide range AV eqpt, self-pacing carrels. High cost eqpt centrally located	Many years, millions of hours vocational training within company	Great emphasis on modern training techniques and facilities. Limited contract training.
1033.4	Industrial Vocational Technical Management (aircraft oriented)	Training Div. of Industry, with extensive facilities at industrial and remote sites	Large organization of admin, technical and instructional specialists	Advanced systems approach, educational research, centralized development	Wide range of advanced, costly media, including CMI, simulators	Over 30 years experience, government and commercial training sales in high volume	Very active in development, promotion and sale of training systems to customer requirements. Contract training.
1033.5	Automotive maintenance, sales technical	Limited--one well equipped classroom at Headquarters	Adequate number of qualified personnel used as instructors as needed. Small training staff	Packaged instructional courses-21 programs conventional approach programmed instruction	CCTV, viewgraph, displays, 16mm proj. at HQ portable cabinet w/video casette, CRT, etc.	Many years exper. in-house training for distributors and affiliates	Fleet maintenance program supports largest fleet of ____ trucks in the world. No contract training.
1033.6	Pilot, aircrew, acft maintenance Flight attendant Management	3 training center complexes Limited classroom space, extensive simulator facilities	Well staffed with highly qualified instructors. Good technical support	Systems approach emphasis on course compression, simulator use in lieu of air trng	Flt simulators, CPTs, classrooms equipped viewgraphs, slide, proj. unique panel systems display	Many years training approved by govt regulatory agency	Primarily concerned with own training needs
1033.7	Pilot, Flt Engr, acft maintenance Flt steward, clerical	Modern well-equipped trng courses, excellent classroom, support facilities. Advanced trng equipment	Well staffed with highly qualified instructors and technical specialists	Task analysis based, with regulatory agency approval. Programmed instruction, self-paced progression	Wide range of aids and eqpt.: visual, simulators, responders, AV, indiv. carrels, CPTs, CCTV mockups	Many years exper. both in-house and commercial sale training	Emphasis on advanced training techniques and equipment. Contract training

APPENDIX C (Cont'd)

SUMMARY OF INDUSTRY TRAINING ACTIVITIES

SOURCE OF TRAINING	CATEGORIES OF INSTRUCTION	FACILITIES	PERSONNEL RESOURCES	TRAINING SYSTEM DESIGN	TRAINING EQUIPMENT	QUALIFICATIONS AND EXPERIENCE	COMMENTS
1033.8	Pilot, all types acft maintenance (corporate acft)	10 major training centers. U.S. & France well equipped classrooms, training equipment e.g., DC-10, A300B	Staff of 300 highly qualified instructors. Technical specialists with military and airline experience	Instructional system development (ISD) approach. Programmed learning concept "Hands On" emphasis	Visual simulators unique animated panel displays, audio visual equipment	Heavily involved in pilot training for Navy, USAF, several hundred companies and foreign govts.	Specialists in contract flight training 12 yrs Navy, Army,AF, NASA, CC Crew training, maintenance training
1033.9	Gas serviceman: air conditioning, heating, cooling, gas-fired boilers, distribution and corrosion	Single service training CTR - 3 yr old classrooms, labs, technical library	Small staff of instructors, augmented by company and public service engineers	Centralized. Based on manufacturers' data, short courses to 2 weeks, 14-16 students class load	Test and work benches product samples, cutaways, mockups	Training for own personnel and some independent firms. Est. 240 students per yr	Typical of gas service company training throughout U.S. One of the best in the U.S.
1033.10	Electrical lineman and Groundman training power plant electrician supervisor/mgmt	Modern training bldg. with exterior practice area. Some classrooms for mgmt trng (HQ)	Well qualified instructors for small student groups. Ratio 1:5 plant	Instructor developed. Classroom lecture and practical trng based on service manuals (lineman)	Std classrooms & laboratories, practice poles and fleet equipment for exterior practice	Many years experience in producing highly qualified linemen and plant electricians	Typical of electric power company training facilities throughout U.S.
1033.11	Auto mechanic shop skills technical/engineering Business/Mgmt Sales	34 district trng centers for customer training, learning centers at plants. 12 student vans.	High resources of skilled technical instructors. Large education and training department and support facilities	Task analysis and conventional methods designed for customer needs Entry skills "transition" programs	Audio visual aids Actual equipment and parts with work benches plus classroom	Many years successful auto mechanic, assembly skills, technical, engineering and mgmt trng	Major industrial complex utilizing high quality/volume E & T for employees and affiliates
1033.12	Electrical equipment repair and maintenance		Well qualified staff				Contract training in support of their equipment
1033.13	Auto mechanic Diesel engines Technician/Engineer Shop Skills Business/mgmt	College level institute Advanced Techn. Center, Plant schools 30 customer trng Centers (U.S.) and overseas	Very large trng organization, wide range highly qualified educ. and trng specialists and support facilities	Cost-effective, value analysis approach decentralized development, wide range of training levels	Modern appropriate aids and eqpt for wide range of education and trng at all levels	Production quality and customer acceptance rated high over many years	Major industrial producer providing massive internal and customer-affiliate training

APPENDIX C (Cont'd)

SUMMARY OF INDUSTRY TRAINING ACTIVITIES

SOURCE OF TRAINING	CATEGORIES OF INSTRUCTION	FACILITIES	PERSONNEL RESOURCES	TRAINING SYSTEM DESIGN	TRAINING EQUIPMENT	QUALIFICATIONS AND EXPERIENCE	COMMENTS
1033.14	Shop crafts Mechanical technician Electronic technician Mgmt/Sales					Trained 250 marines per yr-Project transition	
1033.15	Electronic Warfare Welding, Soldering Communications	3 major plants and customer facilities	80 corporate, 100 customer instructors. Large technical staff.	Advanced Systems Approach centralized. Computerized Media sel.	Video tape (grp & indiv) Produces color VT, film, hardware	Trained Navy, Marine and Army personnel. LEM program (NASA)	Emphasis on course compression. Large resources of training materials
1033.16	Computer Technology Data Processing Operator Training Communications Systems Skill/Shop Trng	25 plant and district training centers. Sophisticated facilities including workshops	Very large trng and development staff including instructors and technical specialists 350-400 in R&D (Educ.)	Educ. Spec. developed, based on task analysis, "Benefit Cost Analysis" course compression also pkg programs	Wide range multimedia, incl. carrels, CMI, audio-video tape, "real world" equipment	Dominant in industry field. 9 million trng hrs (1972) U.S. and overseas for production, sales and product support	"Largest industry training organization in the world."
1033.17	Photography Shop Skills Graphic Arts Micro-electronics Computer prog. (et al.)	Marketing Educ. Ctr. Centralized facility. Classroom/Lab complex Designed for A-V Presentations	Staff of 190 at M.E.C. (70 full time instructors) large pkg course dev. staff for programmed learning	Systems Approach Task Analysis "Need to Know" Programmed Instruction Course Compression	Slide and 16mm projectors job-skill labs. Evaluating Computer managed video/Audio unit	Industrial trng since 1881. World's largest industrial producer printed, audio-visual materials	Primary source of photographic skills training. Courses for DOD-most at no cost
1033.18	Aircraft and missile maintenance management-Computer, electronics astronautics	8 production plants in U.S., extensive modern facilities and equipment	Very large staff technical and engineering, and instructional specialists	Systems approach. Detailed program, training, technique and media analysis 95 percent confidence goal	Mockups, animated panels, lab/workshops, audio-visual aids, simulators, CCTV, films	Many years internal, military, commercial experience-U.S. & foreign govts.	In-house skill trng (aircraft prod.) Customer training major industrial diversified producer
1033.19	Shop Skills Weapon System Technicians	Extensive classroom facilities at plants and user sites, standardized design and eqpt	Well qualified staff of instructor, technical & support personnel Decentralized activities	Instructor-developed with technical assist. systems approach tas' analysis measurable goals	Micom carrels, work benches, video tape, films, operational eqpt	Many years internal, commercial, and military trng 70-80,000 trng hours/yr	Emphasis on cost-effective trng based on cost/time analyses

APPENDIX C (Cont'd)

SUMMARY OF INDUSTRY TRAINING ACTIVITIES

SOURCE OF TRAINING	CATEGORIES OF INSTRUCTION	FACILITIES	PERSONNEL RESOURCES	TRAINING SYSTEM DESIGN	TRAINING EQUIPMENT	QUALIFICATIONS AND EXPERIENCE	COMMENTS
1033.20	Vocational evaluation and trng programs for 1000 job skills	Several learning centers (contractual) provide services, eqpt, and materials to user	Large staff of specialists in trng development, trng eqpt production	Packaged vocational evaluation and skill trng. Systems Approach. "Hands On" emphasis	Multi-media CCTV, slide/strip, audio, carrels, equipped with tools, testing equipment	Many years experience in contractual trng and equipment for government agencies	Major producer of Flt simulators audio-visual eqpt and training prog. unique aptitude testing
1033.21	Electronics communications advanced torpedoman sonar Computer systems	Technical institute. Most trng done at user facilities, including military installations	Large staff of course development specialists, technicians, and instructors	Highly developed systems approach design, development production, installation real world environment	Multi-media, labs, workshops, classroom aids, symbolic integrated maint. manuals (simm)	Successful instructional systems dev. for major airline, Navy, Marines. Production Trng	Major electronics concern with deep involvement in training development for commercial sale
1033.22	Electronics Computer Prog. Sales	New learning ctr Learning carrels 20 classrooms (12-20) auditorium (200) CCTV equipped	Small, well organized staff-curriculum developers, tech writers, studio support, engineers and technicians from Engineering Branch	Specialized trng "information compression" by electronic media Programmed materials Conventional approach	Emphasis on video, audio tape, CAI, CMI, multi-carrels (no Lab fac.) (B & W TV)	Newly organized for training develop. and sale--expanding 2 Navy pgms (now). Taiwan assembly plant	Electronic mfr developing aggressive trng course sales program for specialized skills
1033.23	Acft pilots, flt. engineers acft maintenance steward	Instructor Academy (no data)		Systems Approach Task Analysis FAA approved	Video tape		Major airline
1033.24	Acft pilots Flt engineers Acft maintenance steward	11 classrooms fixed desks with responder sys. limited; for small student load	Highly qualified instructors. Program managers materials specialists	Systems approach oriented. Task analysis FAA approved			
1033.25							

APPENDIX C (Cont'd)

SUMMARY OF INDUSTRY TRAINING ACTIVITIES

SOURCE OF TRAINING	CATEGORIES OF INSTRUCTION	FACILITIES	PERSONNEL RESOURCES	TRAINING SYSTEM DESIGN	TRAINING EQUIPMENT	QUALIFICATIONS AND EXPERIENCE	COMMENTS
1033.26	No data	World-wide facilities	Excellent staff	Systems approach to training	CCTV, carrels	Many years experience	High capability both in-house and contract for all levels of training
1033.27	Electronics Shop skills Automotive Drafting Copy machines	Tech. Trng Center 500 rooms/1000 students Mfg Training Centers Very high capacity	Large group of training course developers, vocational and technical instr engineer advisers	Scientific systems approach- "Function contact training" programmed instruction performance goals	CCTV, video tape audio cassettes on-the-job job simulators microfiche	High volume sale of training: $115K in 1972. Several years successful operations	High capability for vocational and technical training